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Supplement to
The Desert Project Soil Monograph
Volume III

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Supplement to the Desert Project Soil Monograph

Soils and Landscapes of a Desert Region Astride the Rio Grande Valley Near Las Cruces, New Mexico

Volume III

L.H. Gile, R.J. Ahrens, and S.P. Anderson, Editors

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Cover: View of a Pachic Halpustoll and an Ustic Haplargid in the Soledad Canyon of the Organ Mountains. The Pachic Halpustoll (Santo Tomas 60-12), which formed in Organ alluvium of Holocene age, is at the tape in the foreground. The Ustic Haplargid (Caralampi), which formed in Jornada alluvium of middle Pleistocene age, is in the middle background. The Organ Mountains are on the skyline.

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Foreword

Volume III of the *Supplement to the Desert Project Soil Monograph* is the third in a number of volumes about soils and landscapes in the Desert Project area. Volume III consists of two chapters. The first is an update of the Desert Project soil survey, along with many illustrations of its features. Because of the high significance of carbon in studies of global change, particular attention is paid to composition of the map units with respect to both organic and carbonate carbon. This information has been used in the second chapter on areal evaluation of organic and carbonate carbon.

Recent advances in color technology and computer-generated maps have been used in sections involving both general and detailed soil maps, maps of morphological and physiographic features, and maps illustrating soil-geomorphic reconstruction. In addition, color photography has been used to illustrate the effects of increasing precipitation from the arid to the semiarid zone; the effects of moisture differences resulting from surface and subsurface concentrations of moisture; sites dated by radiocarbon ages of buried charcoal; other features of the semiarid zone; and soils of Holocene scarps in high-carbonate parent materials. Land survey notes, grazing records, aerial photographs, and present conditions indicate extensive dune formation and dramatic changes in vegetation from about 1885 to 1936. Repeat photography documents major vegetation changes in the last 20 to 80 years.

L.H. Gile, R.J. Ahrens, and S.P. Anderson, Editors

Figure 1.—Location of the Desert Project in Dona Ana County, southern New Mexico.

Chapter 1: New Maps, Photography, and Data [1]

Introduction

The Desert Soil-Geomorphology Project (informally termed the Desert Project) is a study of soil and landscape evolution carried out by Soil Survey Investigations, USDA-SCS, from 1957 to 1972 (Hawley, 1975). Figures 1 and 2 show the location of the project area, figure 3 shows the major landforms, and color map 1, at the back of this publication, shows the topography, the parent material of the soils, and the general climatic zones.

Studies of soils and soil-geomorphic relationships were presented in *The Desert Project Soil Monograph* (Gile and Grossman, 1979). Additional soil-geomorphic work done in the Desert Project area is presented as supplements to the Desert Project soil monograph and guidebook. A supplement to the guidebook has been prepared (Gile et al., 1995b). For the soil monograph, the supplementary work is

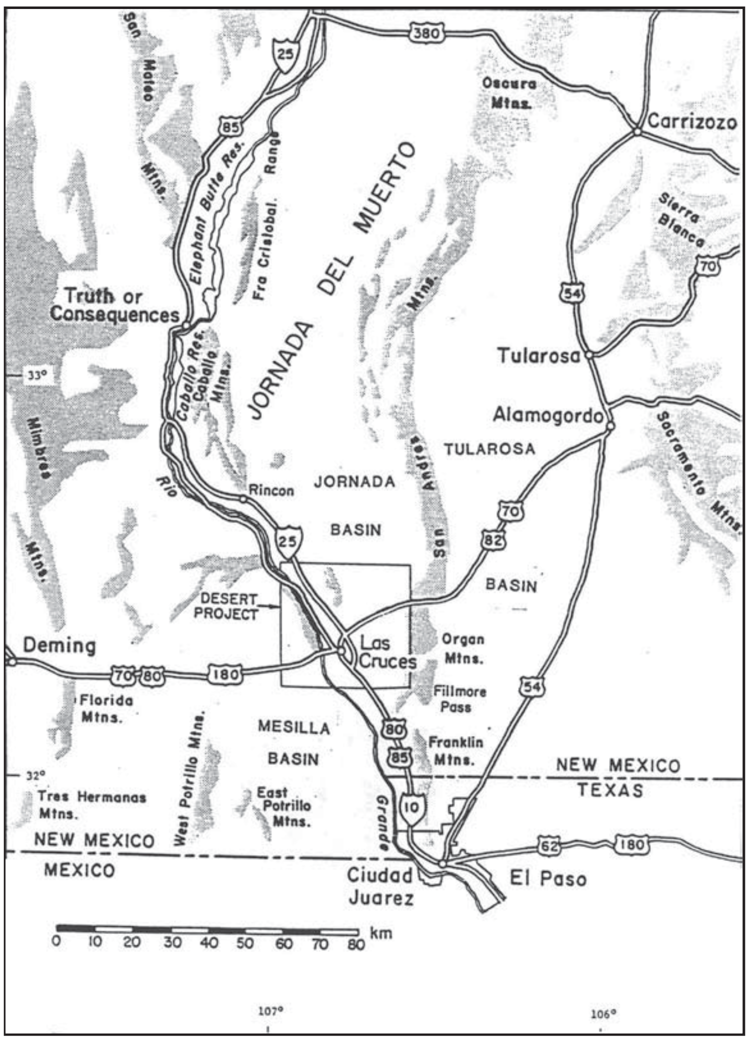

Figure 2.—Location of the Desert Project in the Basin and Range country of southern New Mexico.

[1] By L.H. Gile, Soil Scientist (retired), USDA, NRCS, Las Cruces, NM; R.B. Grossman, Research Soil Scientist, USDA, NRCS, Lincoln, NE; and R.J. Ahrens, Director, National Soil Survey Center, Lincoln, NE.

presented as a series of volumes. Volume I (Herbel et al., 1994) details soil water and soils at soil water sites in the Jornada Experimental Range. Volume II presents ancient soils of the Rincon surface (Gile et al., 1996) and clay mineralogy at the Desert Project and Rincon surface study areas (Monger and Lynn, 1996). The present volume (volume III) updates the Desert Project soil survey, presents new maps of soils and soil features, and includes a chapter on areal distribution of carbon. This work was carried out in cooperation with the Global Change Program (Grossman et al., 1995). Details of climate, fauna, flora, and history in the Desert Project area are in *The Desert Project Soil Monograph* (Gile and Grossman, 1979). Thin sections are from Gile et al. (1995b).

Sheet Illustrations

Sheet illustrations, mostly about 32 x 42 inches in size, are on a CD that accompanies this publication. There is some repetition of text material in the sheets because the sheets are intended to be used independently of the text as well as with it. The sheet illustrations are suitable for use in orientation sessions in the field, in the classroom, for wall displays, and as posters for meetings. The titles of the sheets are listed below along with the titles of individual sections:

1. Physiographic, climatic, and pedogenic setting of the Desert Project
    a. Location of the Desert Project
    b. Physiography

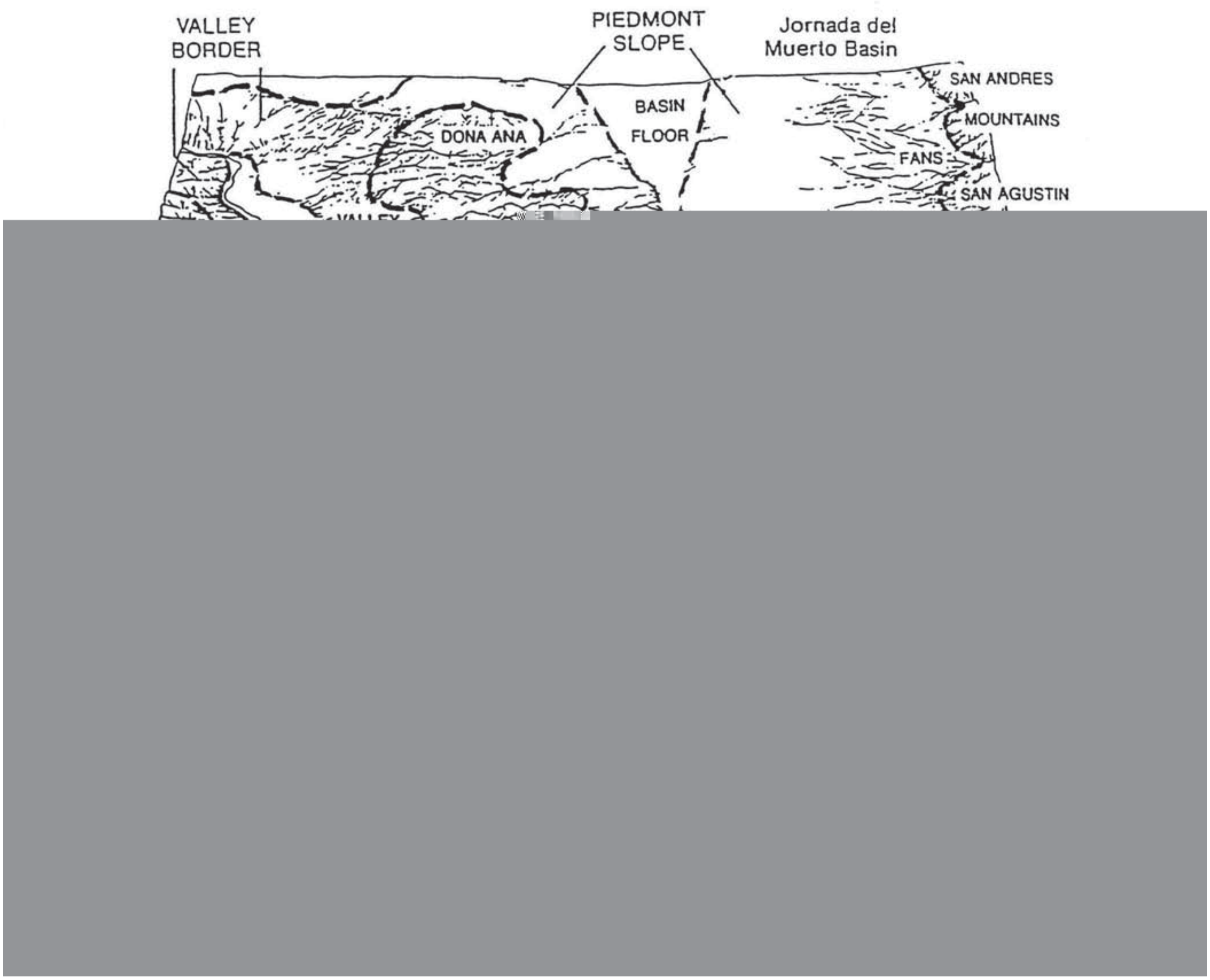

Figure 3.—Some of the major landforms at the Desert Project. The flood plain along the Rio Grande is about 8 kilometers wide at the cross section.

   c. Topography, soil parent materials, and general climatic zones
   d. General soil map
2. Chronology of the Desert Project and vicinity
   a. The soil chronology
   b. The Jornada and Mesilla Basins, chronology of La Mesa surfaces, and time of entrenchment of the Rio Grande Valley
3. Illustrative morphological features
   a. The argillic horizon
   b. The mollic epipedon and its analog
   c. Stages of carbonate accumulation
   d. Stage of carbonate accumulation associated with the argillic horizon
4. Some effects of human activities on eolian erosion and deposition: Historical coppice dunes
   a. Map of historical coppice dunes
   b. Historical record
   c. 1993 photograph
   d. 1936 aerial photograph
5. Soil-geomorphic reconstruction: The soil chronology, argillic horizon, and stages of carbonate accumulation at the end of the last Pleistocene full-glacial, 17,000 years ago
   a. The soil chronology, 17,000 years ago
   b. The argillic horizon, 17,000 years ago
   c. Stages of carbonate accumulation, 17,000 years ago
6. Soil-geomorphic reconstruction: The Jornada I surface (estimated age: 250,000 to 400,000 years), deposits of the ancestral Rio Grande, and intervening buried soils south of Highway 70
   a. Cross sections from stable Jornada I to an estimated Jornada I flood plain
   b. Position of Jornada I in the stepped sequence of geomorphic surfaces along the valley border
   c. Structural benches and exhumed deposits of the ancestral Rio Grande
   d. Formation of a structural bench
7. The detailed soil map at reduced scale (A printed copy of this sheet is at the back of this book.)

Fourteen color maps 11 x 17 inches in size are smaller scale editions of the first six of the large sheets on the CD. These 14 maps, along with sheet 7 and 28 detailed soil maps, are at the back of this publication. The numbers and titles of the 14 color maps are as follows:

1. Topography, soil parent materials, and general climatic zones
2. The Jornada and Mesilla Basins
3. The soil chronology
4. Carbonate stage
5. The mollic epipedon and its analog
6. The argillic horizon
7. The argillic horizon and dominant carbonate stage
8. General soil map
9. Soil-geomorphic reconstruction: The soil chronology at the end of the last Pleistocene full-glacial, 17,000 years ago
10. Soil-geomorphic reconstruction: The argillic horizon at the end of the last Pleistocene full-glacial, 17,000 years ago
11. Soil-geomorphic reconstruction: The stages of carbonate accumulation at the end of the last Pleistocene full-glacial, 17,000 years ago
12. Constructional surfaces vs. structural benches
13. The Jornada I surface, deposits of the ancestral Rio Grande, and intervening buried soils south of Highway 70
14. Coppice dunes

Pedogenic and Geomorphic Setting

The amount of carbon in the terrestrial biosphere is a major factor in considering global climatic change (Grossman et al., 1995). The Desert Project can contribute to this work because it covers a large (400 square miles) arid and semiarid region in which detailed field and laboratory studies involving both organic and carbonate carbon have been conducted. Fieldwork included mapping the soils at a scale of 1:15,840, as well as selected areas at a scale of 1:7,920 (Gile and Grossman, 1979; Gile et al., 1981, 1995b). Pedons in the Desert Project and nearby areas have been analyzed by the National Soil Survey Laboratory (NSSL) and others (table 1, Appendix).

An important aspect of increasing usefulness of the laboratory analyses to both soil-geomorphic research and the Global Change Program would be to find ways of extrapolating organic and carbonate carbon data from the analyzed pedons to the Desert Project as a whole. Many different soils occur in the Desert Project because of wide differences in soil age, parent materials, climate, topography, microrelief, and biotic activity. Although laboratory analyses are not available for most soils, close soil-geomorphic control places all soils in a chronological framework for the area, as is discussed later. Because accumulation of inorganic carbon in the form of carbonate is an age-related property of soils, this chronological framework and carbonate morphology, along with other morphological properties, such as soil texture, can be used in selecting an analyzed pedon or pedons that would be suitable as substitutes when data on a given soil are not available. Organic carbon is not well related to soil age but is closely related to clay content, vegetation, landscape position, microrelief, gravel content, and climate (arid vs. semiarid). These factors were considered in selecting analyzed pedons to use as substitutes for soils with no organic carbon data.

For the foregoing reasons, the estimated percentages of soils in map units of the Desert Project soil survey are very important figures in extrapolating data from the analyzed pedons to the project as a whole. To increase the precision of both the soil map and extrapolations from it, the composition and boundaries of the map units were reexamined and new map units were added. The mapping was then transferred from the 1936 and 1942 photography used in the original maps to 1984 aerial photography (with a more accurate scale) used in this publication. A preliminary extrapolation of carbon data (Grossman et al., 1995) was prepared using the old soil maps and information available at the time the paper was written. The report by Grossman et al. (chapter 2 of this volume) utilizes the new maps and additional information now available.

In the tables showing map unit composition and carbon source, the latter is indicated primarily by pedon numbers of soils sampled by the National Soil Survey Laboratory (Appendix). Carbon data from a smaller number of other pedons were derived from sources indicated in table 1 and in the Appendix.

Horizon designations follow the Soil Survey Division Staff (1993), except for the K horizon nomenclature (Gile et al., 1965) and the designations for buried soils, which are placed at the end of the designation to handle pedons with more than one buried soil. Use of the K horizon has spread because, as noted by Birkeland (1984), "Most pedologists and geologists working in arid lands find it a very useful term."

The stages of carbonate accumulation (table 2) follow Gile et al. (1966) and Birkeland et al. (1991). The stage nomenclature that we developed for the morphogenetic evolution of carbonate horizons (Gile et al., 1966) has also been followed in genetic models for the formation of silcrete and ferricrete, as well as for carbonate horizons (Goudie, 1973, p. 9, 10). Color map 1 shows the topography, parent materials, and general climatic zones of the Desert Project, which occurs partly in the Jornada Basin and partly in the Mesilla Basin (fig. 2 and color map 2).

Geomorphic surfaces (table 2 and color map 3) are useful in studies of soils because they provide a chronological framework and a common thread that makes the soil patterns easier to understand. Most geomorphic surfaces in the study area are extensive, and their surficial sediments, in which the soils have formed, can range widely in mineralogy, texture, and climatic occurrence. Many kinds of soil can therefore occur on a single geomorphic surface. However, a common feature of the various soils on a given surface is the degree of soil development, taking into account the effects of changes in parent materials and climate. Thus, soil morphology can provide important evidence for the identification of geomorphic surfaces, especially where deposits of widely variable ages occur at the same elevation. In such cases soil morphology offers the major evidence for identification of geomorphic surfaces (Gile, 1977).

Because soils of different geomorphic surfaces also differ, often profoundly, boundaries between geomorphic surfaces also approximate boundaries between soils. For example, boundaries between assembled soils of the Organ surface (color map 3) are also approximate boundaries between the Organ and pre-Organ surfaces.

Table 2 shows the relationships between soils of the geomorphic surfaces, stages of carbonate accumulation, and totals of pedogenic carbonate. The surfaces occur on all parts of the landscape—alluvial fans, coalescent fan piedmonts, basin floors, terraces, ridges, and arroyo channels. The terminology of Hawley and Kottlowski (1969) has been followed in designating materials associated with the surface by the geomorphic surface name (e.g., Fillmore alluvium).

The stages of carbonate accumulation (color map 4) are valuable chronological and stratigraphic markers for the soils and deposits. Table 2 summarizes the stages for soils on the valley border, piedmont slope, and basin floor north of Highway 70.

The La Mesa geomorphic surface of Ruhe (1967) is now known to consist of relict basin-floor surfaces of at least three ages (Gile, 2002). Magnetostratigraphy at the upper La Mesa (the oldest of the three; fig. 3) indicates that the soils there are about 2 to 2$^{1}/_{2}$ million years old (Mack et al., 1993). Magnetostratigraphy for an area of the lower La Mesa (the youngest of the three) at the Desert Project has been identified as Matuyama (Mack et al., 1998). South of the Desert Project (near La Union; color map 2) another area of the lower La Mesa has been identified as Brunhes (Vanderhill, 1986). The true age of the lower La Mesa could be close to 780,000 years, the boundary between Brunhes and Matuyama. This age also agrees with the approximate time of valley entrenchment at Rincon Arroyo (Mack et al., 1998). This evidence suggests that soil development began in the abandoned lower La Mesa flood plain about 780,000 years ago.

Because of valley downcutting and the narrow width between the Dona Ana and Robledo Mountains, no remnant of the La Mesa surface has been preserved there. Thus, the upper and lower La Mesa surfaces cannot be directly traced to the Jornada Basin, and their ages relative to La Mesa in the Jornada Basin cannot be demonstrated. However, a combination of paleomagnetism, dated pumice, carbonate morphology, and totals of pedogenic carbonate indicate that La Mesa in the Jornada Basin ranges from about 780,000 to 2,000,000 years old (Gile, 2002). Thus, La Mesa in the Jornada Basin is intermediate in age between the upper and lower La Mesa at the Desert Project. To distinguish La Mesa in the Jornada Basin from the other two, it is termed JER La Mesa, because so much of the Jornada Experimental Range is on it. JER La Mesa also occurs near Goat Mountain on the east side of the valley (fig. 3 and color map 2).

Table 1. —Soil classification and location of laboratory data and pedon descriptions [1]

	Source and page number [2]		
Classification	Pedon designation	Laboratory data	Pedon description
ARIDISOLS			
ARGIDS			
CALCIARGIDS			
Typic Calciargids			
loamy-skeletal			
Pinaleno	59-15	788	789
	67-5	924	925
coarse-loamy			
Yucca	66-1	884	885[6]
	88-2	74, 75[4]	73[4]
	90-1	57[3]	55, 56[3]
	90-100	(5)	(5)
	90-101	(5)	(5)
	99-1	(5)	
Yucca, deep argillic analog	94-4	(5)	(5)
Yucca, deep analog	95-2	(5)	(5)
Yucca, calcareous analog	95-3	(5)	(5)
fine			
Continental	67-6	926	927
	T-2100	(5)	
	T-2200	(5)	
fine-loamy			
Berino	59-6	770	771
	59-8	774	775
	60-7	808	809
	60-13	822	823
	68-2	930	931
	68-9	944	945
	70-7	956	957
	68-8	66, 67[4]	64, 65[4]
Dona Ana	60-6	806	807[6]
	61-4	850	851
	65-5	878	879
	68-6	938	939
	T-2307	(5)	
	T-2411	(5)	
	96-2	(5)	(5)
Hap			
Tres Hermanos	96-1	(5)	(5)
Ustic Calciargids			
loamy-skeletal			
Nolam			(6)
fine-loamy			
Hap, Ustic analog			
Headquarters	60-18	832	833[6]
			576
McAllister			
fine			
Stellar	61-3	848	849[6]
	90-8	419, 420	421
	60-21	838	839
Vertic Calciargids			
fine			
Joveatch			969[6]
PALEARGIDS			
Arenic Paleargids			
fine-loamy			
SND-3	95-1	(5)	(5)
HAPLARGIDS			
Typic Haplargids			
loamy-skeletal			
Soledad	66-16	914	915[6]
	67-4	922	923
sandy			
Sonita, sandy analog	94-3	(5)	(5)
coarse-loamy			
Sonoita	60-8	812	813
	72-3	966	967
	92-3	(5)	(5)
	90-6	217[3]	215, 216[3]
Onite	62-3	868	869
	70-5	952	953
	70-6	954	955
	61-5	852	853
	61-9	862	863
	T-1100	(5)	(5)
	T-1200	(5)	(5)
	T-1303	(5)	(5)
Onite, thin solum analog	68-5	936	937
sandy			
Onite, sandy analog	59-5	768	769
	68-3	932	933

See footnotes at end of table.

Table 1. —Soil classification and location of laboratory data and pedon descriptions—continued [1]

Classification	Source and page number [2]		
	Pedon designation	Laboratory data	Pedon description
ARIDISOLS—continued			
fine-loamy			
Bucklebar	59-7	722	773[6]
	60-22	840	841
	66-8	898	899
	66-14	910	911
	68-4	934	935
	88-1	70, 71[4]	69[4]
fine			
Bucklebar, clayey subsoil analog			
Ustic Haplargids			
loamy-skeletal			
Monza	66-9	900	901[6]
	66-10	902	903
	70-1	948	949
Caralampi	59-14	786	787
	60-23	842	843
	60-9	814	815
Holliday	OMF-1	(5)	(6)
	OMF-6	(5)	
clayey-skeletal			
Eloma			
Eloma, clayey substratum analog			
sandy			
Summerford, sandy analog			
coarse-loamy			
Summerford	KL-82-1	(5)	(6)
fine-loamy			
Bucklebar, Ustic analog	66-15	912	913
fine			
Eloma, fine analog			
Headquarters, fine analog	69-8	946	947
Lithic Ustic Haplargids			
loamy-skeletal			
Lemitar, noncalcareous analog			
PETROARGIDS			
Typic Petroargids			
coarse-loamy			
Rotura	61-8	860	861[6]
	72-1	962	963
	72-2	964	965
	HCM	33[4]	
fine-loamy			
Rotura, fine-loamy analog	65-7	882	883
Ustic Petroargids			
loamy-skeletal			
Terino, deep analog			
CALCIDS			
HAPLOCALCIDS			
Typic Haplocalcids			
loamy-skeletal			
Nickel	59-13	784	785
			329
loamy-skeletal, carbonatic			
Weiser			300
Weiser, discontinuously cemented analog			
sandy-skeletal			
Caliza			294, 398[6]
sandy			
Rilloso	60-11	818	819[6]
	90-10	(5)	(5)
coarse-loamy			
Algerita	61-2	846	847[6]
Algerita, discontinuously cemented analog	61-1	844	845
SND-2	59-9	776	777
SND-1	59-12	782	783
Whitlock	60-2	796	797
Wink, deep gypsum phase	90-4	246[3/]	244, 245[3]
fine-loamy, carbonatic			
Jal	65-6	880	881
Jal, discontinuously cemented analog			
fine-loamy			
Turney taxadjunct	90-7	272[3]	270, 271[3]
fine-silty			
Reakor			
Ustic Haplocalcids			
loamy-skeletal			
Polar			
coarse-loamy			
Whitlock, Ustic analog			
fine-loamy			
Chispa	66-7	896	897
fine-silty			
Reagan	60-14	824	825
	60-17	830	831
	65-1	870	871
	66-6	894	895
	68-7	940	941
	91-10	(5)	(5)
	92-5	(5)	(5)
			972
PETROCALCIDS			
Argic Petrocalcids			
loamy-skeletal, shallow			
Casito	60-1	794	795[6]
			609

See footnotes at end of table.

Table 1. —Soil classification and location of laboratory data and pedon descriptions—continued [1]

Classification	Pedon designation	Laboratory data	Pedon description
	Source and page number [2]		
ARIDISOLS—continued			
Hachita	59-16	790	791[6]
	70-8	958	959
loamy-skeletal			
Hachita, moderately deep analog			
loamy-shallow			
Cruces	61-7	856	857[6]
	66-12	906	907
	94-1	[5]	[5]
coarse-loamy			
Hueco	90-2	87	85, 86[3]
	90-3	117[3]	115, 116[3]
	90-5	168[3]	166, 167[3]
	95-4	[5]	[5]
fine-loamy			
Cacique			[6]
fine			
Cacique, fine analog			
Calcic Petrocalcids			
loamy-skeletal			
carbonatic, shallow			
Tencee	62-1	866	867[6]
			399
loamy, carbonatic, shallow			
Upton	66-5	892	893
Ustalfic Petrocalcids			
loamy-skeletal, shallow			
Terino			[6]
loamy-skeletal			
Terino, mod. deep analog			
clayey-skeletal			
Hayner	60-5	802	803[6]
clayey-skeletal, shallow			
Terino, clayey-skeletal analog			
clayey, shallow,			
Terino, clayey analog			
fine			
Hayner, fine analog			
fine-loamy			
Cacique, Ustalfic analog			
coarse-loamy			
Hueco, Ustalfic analog			
Typic Petrocalcids			
Simona, eroded			
loamy-skeletal, shallow			
Delnorte	61-10	864	865
	66-2	886	887
	67-2		919
			317, 600
	96-3	[5]	[5]

Classification	Pedon designation	Laboratory data	Pedon description
	Source and page n		
ARIDISOLS—continued			
loamy, shallow			
Simona	59-11	780	781
	60-10	816	817
	60-20	836	837
coarse-loamy			
Harrisburg			
sandy, shallow			
Tonuco			
Ustic Petrocalcids			
loamy-skeletal, shallow			
Monterosa			[6]
loamy-skeletal			
Monterosa, mod. deep analog			
loamy, shallow			
Conger			
CAMBIDS			
HAPLOCAMBIDS			
Typic Haplocambids			
loamy-skeletal			
Vado	60-4	800	801[6]
sandy-skeletal			
Tugas			[6]
coarse-loamy			
Pajarito	67-3	920	921
Agustin			
fine-loamy			
Adelino			390
Ustic Haplocambids			
loamy-skeletal			
Gallegos			
coarse-loamy			
Ima			
ENTISOLS			
FLUVENTS			
TORRIFLUVENTS			
Ustic Torrifluvents			
sandy-skeletal			
Minneosa, sandy-skeletal analog			
fine-silty (calcareous)			
Crowflats			
Typic Torrifluvents			
loamy-skeletal (calcareous)			
Anthony, loamy-skeletal analog	65-2	872	873
sandy			
Vinton	59-4	766	767
	67-1	916	917
coarse-loamy (calcareous)			
Anthony	65-3	874	875
	65-4	876	877
Gila			

See footnotes at end of table.

fine-loamy
(_________

Table 1. —Soil classification and location of laboratory data and pedon descriptions—continued [1]

Classification	Source and page number [2]		
	Pedon designation	Laboratory data	Pedon description
MOLLISOLS—continued			
loamy-skeletal			
Santo Tomas, cumulic analog			
Pachic Haplustolls			
loamy-skeletal			
Santo Tomas	60-12	820	821[6]
Santo Tomas, calcareous analog			
coarse-loamy			
Aladdin, calcareous analog	60-19	834	835
Torriorthentic Haplustolls			
sandy-skeletal			
Baylor	OMF-1	(5)	(6)
	OMF-6	(5)	
Baylor, calcareous analog			
sandy			
Hawkeye	59-2	762	763[6]
Aridic Haplustolls			

Classification	Source and page number [2]		
	Pedon designation	Laboratory data	Pedon description
MOLLISOLS—continued			
coarse-loamy			
Aladdin			(6)
PALEUSTOLLS			
Petrocalcic Paleustolls			
clayey-skeletal			
Hayner, mollic analog			
Terino, mollic, mod. deep analog			629
loamy-skeletal, shallow			
Mierhill			
VERTISOLS			
TORRERTS			
HAPLOTORRERTS			
Chromic Haplotorrerts			
very-fine			
Dalby taxadjunct	60-16	828	829

[1] Classification according to the Soil Survey Staff (1999). All series are established. All soils are thermic and have mixed mineralogy unless otherwise stated. All soils with mixed mineralogy are superactive, except for those that are sandy or sandy-skeletal. See table 3 for alphabetical listing of soil series, analogs, phases, and taxadjuncts. Some soils near the Desert Project and in the Jornada Experimental Range and along the Organ Mountains fault are included. Numbers that follow the soil names are abbreviations of numbers of the National Soil Survey Laboratory. In these abbreviations the first number indicates the year of sampling (e.g., pedon 65-2 was sampled in 1965). The prefix OMF designates pedons sampled in the Organ Mountains fault study (Gile, 1994a; e.g., OMF-33). The prefix T designates pedons sampled by Tatarko (1980; e.g., T-2100). The designation KL-82-1 identifies a pedon sampled by Lajtha (personal communication, Kate Lajtha, 1986). The designation HCM identifies a pedon sampled by Monger (Monger et al., 1991). SND means that the series is not designated.

[2, 3, 4, 5, 6] Page numbers without footnotes are in Gile and Grossman, 1979; with footnote 3, in Herbel et al., 1994; footnote 4, in Gile et al., 1995b; and footnote 5, in the Appendix of this volume. Footnote 6 indicates that a current series description in or near the Desert Project is available for the series.

Table 2.—Geomorphic surfaces, stages of carbonate accumulation, and totals of pedogenic carbonate in soils of the valley border, piedmont slope, and basin floor north of Highway 70 [1]

Geomorphic surface and carbonate accumulation (kg/m²)			Carbonate stage		Estimated soil age
Valley border	Piedmont slope	Basin floor	Nongravelly materials	Gravelly materials	(years BP or epoch)
Coppice dunes	Coppice dunes	Whitebottom			Historical (since 1850 A.D.)
		Lake Tank			Present to 150,000
Fillmore (5)	Organ (8-20)		0, I	I	Middle and late Holocene 100 to 7,000
	III		I	I	100(?) to 1,000
	II		I	I	1,100 to 2,100
	I		I	I	2,200 to 7,000
Leasburg (23-186)	Isaacks' Ranch (22-108)		II	II, III	Latest Pleistocene (10,000-15,000)
Late Picacho (111)	Late Jornada II		III	III	Late Pleistocene (15,000-75,000)
Picacho (220)	Jornada II (213-300)	Petts Tank	III	III, IV	Late to middle Pleistocene (75,000-150,000)
Tortugas			III	IV	Late middle Pleistocene (150,000-250,000)
Jornada I	Jornada I (751, 834)	Jornada I (795-1080)	III	IV	Middle Pleistocene (250,000-400,000)
	Dona Ana			IV	>400,000
Buried surfaces and soils					400,000-780,000
Lower La Mesa (992, 1168)			III, IV		Middle to early Pleistocene (780,000)
JER La Mesa (1861, 2296)			IV, V		Early Pleistocene to late Pliocene (780,000-2,000,000)
Upper La Mesa			V		Late Pliocene (2,000,000-2,500,000)

[1] Geomorphic surfaces after Ruhe (1967), Gile et al. (1981, 1995b), and Gile (2002). Materials genetically related to constructional phases of a geomorphic surface are designated by the geomorphic surface name (e.g., Fillmore alluvium; Hawley and Kottlowski,1969). Lower and upper La Mesa and JER La Mesa are not formally considered a part of the valley border but are included here because they form part of a stepped sequence with the valley border surfaces. The late phases of Jornada II and Picacho are relatively minor in extent and have not been separately mapped. They are included here because they occupy a highly significant part of the soil chronology. Coppice dunes have not been formally designated a geomorphic surface but are considered separately here because of their extent and significance to soils of the area. Buried surfaces and soils refer to surfaces and soils that are stratigraphically between the Jornada I soil and alluvium of the ancestral Rio Grande, north and south of Tortugas Mountain. Number after the surface names are single values or ranges of values of totals of pedogenic carbonate (in kg/m^2) in soils of the indicated geomorphic surfaces, from Gile et al. (1981), Monger et al. (1991), and Gile (1993, 1994, 1995, and 2002). The true value for pedogenic carbonate in the late Picacho pedon would be greater than 111 kg/m^2, because the pedon is on a ridge crest that has undergone some erosion (see Gile and Grossman, 1979, p. 331-338 for discussion). Values for JER La Mesa are from soils north of the Desert Project, in the Jornada Experimental Range. Carbonate stages after Gile et al. (1966) and Birkeland et al. (1991). Morphologies are best expressed where "nongravelly" soils contain less than about 20 percent, by volume, gravel, and "gravelly" soils contain more than about 60 percent. Soils that have between 20 percent and 60 percent gravel have intermediate morphologies. Soils of the Picacho and lower La Mesa surfaces illustrate initial development of the stage IV plugged and laminar horizons in gravelly and nongravelly materials respectively.

Soil Taxonomy

The 1994 Classification System for Aridisols

Major changes were made in the classification of Aridisols in 1994 (Soil Survey Staff, 1999). The Aridisols now have seven suborders—Cryids, Salids, Durids, Gypsids, Argids, Calcids, and Cambids, instead of two (Orthids and Argids). Of the seven new suborders, three (Argids, Calcids, and Cambids) occur in the Desert Project. The main changes involve the suborder, great group, and subgroup. Table 1 gives the classification of Desert Project soils according to the 1994 system and identifies soils sampled by the National Soil Survey Laboratory since the Desert Project began in 1957. Table 3 lists the soils in alphabetical order.

Diagnostic Horizons

Diagnostic horizons in the study area are the ochric and mollic epipedons and the argillic, cambic, calcic, and petrocalcic horizons, all of which are illustrated in the later section on color photography. Color maps 4, 5, and 6 show the generalized occurrence of the mollic epipedon and its analog, the argillic horizon, and the stages of carbonate accumulation. The stages of carbonate accumulation are important pedogenic markers in the soils and can be related to the diagnostic calcic and petrocalcic horizons. In low-carbonate parent materials, all stage III horizons and late stage II horizons qualify as calcic horizons. In high-carbonate parent materials, most stage I horizons qualify as calcic horizons because their parent materials already contained 15 percent or more of $CaCO_3$ equivalent, one of the requirements of the calcic horizon in fine-loamy or finer materials. Stage IV, V, and plugged stage III horizons all qualify as petrocalcic horizons.

The mollic epipedon and the Mollisols occur only in the semiarid zone (color map 5). Analogs of the mollic epipedon, however, do occur in the arid zone. The analog of a mollic epipedon, as used here, is an epipedon that meets the organic carbon and thickness requirements of a mollic epipedon, but not the color requirements. Color map 5 shows the occurrence of the mollic epipedon and its analog in the study area. Because of run-in and finer texture, some Aridisols on the basin floors and on the lower piedmont slopes in the arid zone have more organic carbon than some of the Mollisols in the semiarid zone along the mountain fronts. For example, pedon 60-12, a Pachic Haplustoll (elevation 5,700 feet, in the semiarid zone) has 4.6 kg/m^2 organic carbon to a depth of 104 cm; the dominant texture in the 0-124 cm zone is very gravelly sandy loam. In contrast, pedon 60-21, an Ustic Calciargid (elevation 4,300 feet, on the basin floor of the arid zone) has 6.0 kg/m^2 organic carbon to a depth of 99 cm; clay is the dominant texture in the 0-99 cm zone.

Soil age, carbonate content of the parent materials, landscape stability, biotic activity, and carbonate accumulations are important factors affecting the argillic horizon (see Gile, 1975a and 1975b, for a detailed discussion of the occurrence of the argillic horizon). Some soils are so young that an argillic horizon has not had time to form (e.g., the soils of coppice dunes and the youngest soils of the Fillmore and Organ surfaces). Color maps 6 and 7 show occurrence of the argillic horizon and of the argillic horizon and dominant carbonate stage, respectively.

The argillic horizon has not developed in parent materials with abundant fragments of high-carbonate rocks, such as limestone. It has not developed even in soils of Pleistocene age that must have formed in part during times of greater effective moisture, as shown by soils of that age downslope from the Robledo Mountains (color map 6). An argillic horizon can form in Pleistocene (but not Holocene) soils that formed in parent materials with only moderate amounts of carbonate, as shown by soils downslope from the San Andres Mountains (color map 6).

After an argillic horizon has formed, it can be obliterated by erosion, biotic activity, and carbonate engulfment, as is shown by the sparsity or absence of the argillic horizon in the dissected terrain bordering the Rio Grande Valley (color map 6), where the parent materials are low in carbonates.

Typic vs. Ustic Aridisols

Ustic subgroups of Aridisols have more moisture than the Typic subgroups; the moisture regime borders ustic (Soil Survey Staff, 1994). No satisfactory definition presently exists for a moisture regime bordering ustic. However, changes in plants, general soil moisture conditions, and elevation are now being used to establish a boundary between the Ustic and Typic subgroups (personal communication, 1992, Bob Ahrens). In the Desert Project, markedly more moisture occurs in two general situations. One is from runoff, and the other occurs towards the mountains.

Table 3.—Alphabetical list of soil series, analogs, and taxadjuncts

Series, analog, or taxadjunct	Classification [1]
Adelino	Typic Haplocambids, fine-loamy
Agustin	Typic Haplocambids, coarse-loamy
Aladdin	Typic Haplustolls, coarse-loamy
Aladdin, calcareous analog	Pachic Haplustolls, coarse-loamy (calcareous)
Aladdin, calcic analog	Aridic Calciustolls, coarse-loamy
Algerita	Typic Haplocalcids, coarse-loamy
Algerita, disc. cemented analog	Typic Haplocalcids, coarse-loamy
Amole	Typic Torriorthents, sandy
Anthony	Typic Torrifluvents, coarse-loamy (calcareous)
Anthony, loamy-skeletal analog	Typic Torrifluvents, loamy-skeletal (calcareous)
Arizo	Typic Torriorthents, sandy-skeletal
Baylor	Torriorthentic Haplustolls, sandy-skeletal
Baylor, calcareous analog	Torriorthentic Haplustolls, sandy-skeletal
Berino	Typic Calciargids, fine-loamy
Bluepoint	Typic Torripsamments
Bodecker	Ustic Torriorthents, sandy-skeletal
Bodecker, sandy analog	Ustic Torriorthents, sandy
Boracho	Petrocalcic Calciustolls, loamy-skeletal, shallow
Boracho, carbonatic analog	Petrocalcic Calciustolls, loamy-skeletal, carbonatic, shallow
Bucklebar	Typic Haplargids, fine-loamy
Bucklebar, clayey subsoil analog	Typic Haplargids, fine
Bucklebar, Ustic analog	Ustic Haplargids, fine-loamy
Cacique	Argic Petrocalcids, fine-loamy
Cacique, fine analog	Argic Petrocalcids, fine
Cacique, Ustalfic analog	Ustalfic Petrocalcids, fine-loamy
Caliza	Typic Haplocalcids, sandy-skeletal
Canutio	Typic Torriorthents, loamy-skeletal (calcareous)
Caralampi	Ustic Haplargids, loamy-skeletal
Casito	Argic Petrocalcids, loamy-skeletal, shallow
Chispa	Ustic Haplocalcids, fine-loamy
Conger	Ustic Petrocalcids, loamy, shallow
Continental	Typic Calciargids, fine
Coyanosa	Lithic Ustic Torriorthents, loamy-skeletal
Crowflats	Ustic Torrifluvents, fine-silty (calcareous)
Cruces	Argic Petrocalcids, loamy, shallow
Dalby taxadjunct	Chromic Haplotorrerts, very-fine
Dalian	Typic Torriorthents, loamy-skeletal, carbonatic
Dalian, sandy-skeletal analog	Typic Torriorthents, sandy-skeletal, carbonatic
Delnorte	Typic Petrocalcids, loamy-skeletal, shallow
Dona Ana	Typic Calciargids, fine-loamy
Earp	Aridic Argiustolls, loamy-skeletal
Earp, fine analog	Aridic Argiustolls, fine
Earp, clayey-skeletal analog	Aridic Argiustolls, clayey-skeletal
Earp, clayey-skeletal, calcic analog	Aridic Argiustolls, clayey-skeletal
Eloma	Ustic Haplargids, clayey-skeletal
Eloma, clayey substratum analog	Ustic Haplargids, clayey-skeletal
Eloma, fine analog	Ustic Haplargids, fine
Gallegos	Ustic Haplocambids, loamy-skeletal
Gila	Typic Torrifluvents, coarse-loamy (calcareous)
Glendale	Typic Torrifluvents, fine-silty (calcareous)

See footnote at end of table.

Table 3.—Alphabetical list of soil series, analogs, and taxadjuncts—continued

Series, analog, or taxadjunct	Classification[1]
Glendale, fine-loamy analog	Typic Torrifluvents, fine-loamy (calcareous)
Hachita	Argic Petrocalcids, loamy-skeletal, shallow
Hachita, mod. deep analog	Argic Petrocalcids, loamy-skeletal
Hap	Typic Calciargids, fine-loamy
Hap, Ustic analog	Ustic Calciargids, fine-loamy
Harrisburg	Typic Petrocalcids, coarse-loamy
Hathaway	Aridic Calciustolls, loamy-skeletal
Hathaway, sandy-skeletal analog	Aridic Calciustolls, sandy-skeletal
Hawkeye	Torriorthentic Haplustolls, sandy
Hayner	Ustalfic Petrocalcids, clayey-skeletal
Hayner, fine analog	Ustalfic Petrocalcids, fine
Hayner, mollic analog	Petrocalcic Paleustolls, clayey-skeletal
Headquarters	Ustic Calciargids, fine-loamy
Headquarters, fine analog	Ustic Haplargids, fine
Herbel	Typic Torriorthents, coarse-loamy (calcareous)
Herbel, Ustic analog	Ustic Torriorthents, coarse-loamy (calcareous)
Holliday	Ustic Haplargids, loamy-skeletal
Hueco	Argic Petrocalcids, coarse-loamy
Hueco, Ustalfic analog	Ustalfic Petrocalcids, coarse-loamy
Ima	Ustic Haplocambids, coarse-loamy
Jal	Typic Haplocalcids, fine-loamy, carbonatic
Jal, disc. cemented analog	Typic Haplocalcids, coarse-loamy, carbonatic
Joveatch	
Kimbrough	Petrocalcic Calciustolls, loamy, shallow
Kokan	Typic Torriorthents, sandy-skeletal
Lacita, buried soil analog	Ustic Torriorthents, fine-silty, (calcareous)
Lemitar, non-calcareous analog	Lithic Ustic Haplargids, loamy-skeletal
Limpia	Pachic Argiustolls, clayey-skeletal
McAllister	Ustic Calciargids, fine-loamy
Mescal	Typic Torriorthents, fine-loamy (calcareous)
Mierhill	Petrocalcic Paleustolls, loamy-skeletal, shallow
Minneosa, sandy-skeletal analog	Ustic Torrifluvents, sandy-skeletal
Monterosa	Ustic Petrocalcids, loamy-skeletal shallow
Monterosa, mod. deep analog	Ustic Petrocalcids, loamy-skeletal
Monza	Ustic Haplargids, loamy-skeletal
Nickel	Typic Haplocalcids, loamy-skeletal
Nolam	Ustic Calciargids, loamy-skeletal
Nolam, mollic analog	Aridic Argiustolls, loamy-skeletal
Onate	Aridic Argiustolls, coarse-loamy
Onite	Typic Haplargids, coarse-loamy
Onite, sandy analog	Typic Haplargids, sandy
Onite, thin solum analog	Typic Haplargids, coarse-loamy
Pajarito	Typic Haplocambids, coarse-loamy
Pinaleno	Typic Calciargids, loamy-skeletal
Polar	Ustic Haplocalcids, loamy-skeletal
Reagan	Ustic Haplocalcids, fine-silty
Reakor	Typic Haplocalcids, fine-silty
Rilloso	Typic Haplocalcids, sandy
Rotura	Typic Petroargids, coarse-loamy
Rotura, fine-loamy analog	Typic Petroargids, fine-loamy
Santo Tomas	Pachic Haplustolls, loamy-skeletal
Santo Tomas, calcareous analog	Pachic Haplustolls, loamy-skeletal
Santo Tomas, cumulic analog	Cumulic Haplustolls, loamy-skeletal

See footnote at end of table.

Table 3.—Alphabetical list of soil series, analogs, and taxadjuncts—continued

Series, analog, or taxadjunct	Classification [1]
Simona	Typic Petrocalcids, loamy, shallow
Simona, eroded	Typic Petrocalcids
SND-1	Typic Haplocalcids, coarse-loamy
SND-2	Typic Haplocalcids, coarse-loamy
SND-3	Arenic Paleargids, fine-loamy
Soledad	Typic Haplargids, loamy-skeletal
Sonoita	Typic Haplargids, coarse-loamy
Sonoita, sandy analog	Typic Haplargids, sandy
Stellar	Ustic Calciargids, fine
Summerford	Ustic Haplargids, coarse-loamy
Summerford, sandy analog	Ustic Haplargids, sandy
Tencee	Calcic Petrocalcids, loamy-skeletal, carbonatic, shallow
Terino	Ustalfic Petrocalcids, loamy-skeletal, shallow
Terino, clayey analog	Ustalfic Petrocalcids, clayey, shallow
Terino, clayey-skeletal analog	Ustalfic Petrocalcids, clayey-skeletal, shallow
Terino, mod. deep analog	Ustalfic Petrocalcids, loamy-skeletal
Terino, mollic, mod. deep analog	Petrocalcic Paleustolls, clayey-skeletal
Terino, deep analog	Ustic Petroargids, loamy-skeletal
Tome	Typic Torriorthents, fine-silty (calcareous)
Tonuco	Typic Petrocalcids, sandy, shallow
Tres Hermanos	Typic Calciargids, fine-loamy
Tugas	Typic Haplocambids, sandy-skeletal
Turney taxadjunct	Typic Haplocalcids, fine-loamy
University	Typic Torripsamments
Upton	Calcic Petrocalcids, loamy, carbonatic, shallow
Vado	Typic Haplocambids, loamy-skeletal
Vinton	Typic Torrifluvents, sandy
Weiser	Typic Haplocalcids, loamy-skeletal, carbonatic
Weiser, disc. cemented analog	Typic Haplocalcids, loamy-skeletal, carbonatic
Whitlock	Typic Haplocalcids, coarse-loamy
Whitlock, Ustic analog	Ustic Haplocalcids, coarse-loamy
Wink, deep gypsum analog	Typic Haplocalcids, coarse-loamy
Yturbide	Typic Torripsamments
Yucca	Typic Calciargids, coarse-loamy
Yucca, deep argillic analog	Typic Calciargids, coarse-loamy
Yucca, calcareous analog	Typic Calciargids, coarse-loamy
Yucca, deep analog	Typic Calciargids, coarse-loamy

[1] Classification is according to the Soil Survey Staff (1999). All series are established. All soils are thermic and have mixed mineralogy unless otherwise indicated. All soils with mixed mineralogy are superactive, except for those that are sandy or sandy-skeletal. The term “variant” has been discontinued and is here replaced by the term “analog” for informal use. SND means that the series is not designated.

Additional Moisture Towards the Mountains

In the Desert Project, semiarid mountain ranges occur upslope of the arid basin and river valley (Gile, 1977; color map 1). The general elevation of about the land surface soil that is classified. However, relatively few buried soils are recognized as such in *Soil Taxonomy*, because the rules for their recognition specify (in addition to thickness requirements) that the materials that bury them (designated a mantle of new material) must be largely unaltered at least in the lower part (Soil Survey Staff, 1999). In addition, the mantle of new material may have a diagnostic surface horizon (epipedon) and/or a cambic horizon, but no other diagnostic horizons. Also, the mantle of new material must have a layer overlying the buried soil that is at least 7.5 cm thick and that fails the requirements of all diagnostic horizons.

Many soils of late or middle Holocene age do not meet these requirements for a mantle of new materials because weak argillic horizons have formed in low-carbonate parent materials and weak calcic horizons have formed in high-carbonate parent materials. If these horizons have not formed, buried diagnostic horizons may become diagnostic for classification, although they are not considered to be buried in the classification system. These soils occur mostly along and near the downslope margins of Organ alluvium, where the alluvium is relatively thin and overlies Pleistocene soils with argillic and/or calcic or petrocalcic horizons. Table 4 summarizes these relationships.

If a soil is buried by a younger deposit, the buried soil is recognized as such in this report, whether or not it meets the requirement of a buried soil for classification purposes.

Table 4.—Conventions for classification of soils with a mantle of new materials (generally of late or middle Holocene age) that lack argillic or calcic horizons [1]

Thickness of deposit	Classification
Less than 50 cm	Overwash phase of buried soils [2]
50 to 100 cm	Herbel [3]
Thicker than 100 cm	Herbel

[1] The illustrative soil in the mantle (where thick enough) is Herbel, a coarse-loamy Typic Torriorthent.

[2] Overwash phases are not separately recognized in this report (table 1) but are included within the concept of the underlying soil. See pedon 96-1, Appendix, for an illustration of an overwash phase.

[3] In highly detailed mapping, such materials may be designated as thin analogs of established series or as buried soil analogs, depending on the emphasis desired (Gile et al., 1995b). See pedon 92-4, Appendix, for an illustration of a buried soil analog. In some instances, the depth required for an argillic horizon (e.g., 50 cm or more in the Arenic Paleargids) is provided by younger sediments that overlie a buried soil. See pedon 95-1, Appendix, for an example.

General Soil Map

Soils of the detailed map, presented later, have been grouped into the 39 map units shown on color map 8. A larger-scale version of the general soil map is presented on sheet 1, on the CD that accompanies this book. The soils have been arranged according to their general physiographic position, as follows: (1) the border of the Rio Grande Valley, including the adjacent relict basin floors; (2) the piedmont slopes; and (3) the basin floor north of U.S. Highway 70. Only the more common soils are shown on the general map. For lists of all observed soils, consult the section "The Detailed Soil Maps."

Soils of the Valley Border and Adjacent Relict Basin Floors

The valley border extends from the flood plain to the relict basin floors, to the valleyward margins of piedmont slopes leading to the mountains, and to the mountains themselves if they are near the valley (color map 8). Parent materials of the valley-border soils originated in two general ways, depending on whether or not the area has a large local watershed. Such watersheds can provide substantial volumes of sediments in the form of fans and terraces that slope into the valley. As the valley continued to entrench, these fans and terraces formed a stepped sequence of geomorphic surfaces related to age (table 2). Map unit 2 illustrates some of the soils formed in sediments derived from noncalcareous igneous rocks, such as rhyolite. Map unit 3 illustrates soils formed in sediments derived mostly from highly calcareous sedimentary rocks, such as limestone. This difference in parent material is important because high-carbonate materials can prevent the formation of an argillic horizon and can speed the development of a petrocalcic horizon. In addition to their genetic significance, both of these are diagnostic horizons of the soil classification system.

If there is no large local watershed, the valley-border soils have formed in sediments exhumed by the downcutting Rio Grande. These materials commonly are either gravelly, erosion-resistant river sediments that form structural benches or less gravelly sands that form sandy ridges. In many places these sands laterally underlie the gravelly sediments of the structural benches. Map units 1 and 7 illustrate soils formed in these kinds of material.

Map units 4, 5, and 6 illustrate soils formed in nearly level sandy sediments of relict basin floors that represent ancient flood plains of the ancestral Rio Grande (the lower and upper La Mesa and JER La Mesa; table 2, color map 3). These three La Mesa surfaces, which are of different ages, form part of a stepped sequence with the valley-border surfaces.

Soils of map unit 8 are of Jornada I age and younger and have formed in sediments derived from the Organ Mountains. These soils are strongly dissected, and buried soils are exposed in many of the ridge sides. Unit 9 is in a single area of the Leasburg surface in the northwest part of the study area. Soils of unit 10 occur mostly on the Picacho surface in the same general area.

No. 1. Bluepoint, University, Kokan, and Yturbide soils (Typic Torripsamments and Torriorthents).—These soils occur on fans and terraces (primarily of Fillmore age) that descend to or are truncated by the flood plain. They also occur on narrow ridge crests and colluvial slopes of ridge sides. On the west side of the valley, where the unit borders units 5 and 6, the ridges are high and steep; a narrow structural bench has formed on gravel-capped ridges. There are common saddles (formed by drainageways encroaching on ridge crests) in the ridges, and slopes of their sides range from 15 to 50 percent. Slopes are gentler on the east side of the valley, commonly ranging from about 3 to 10 percent on ridge sides. The soils have formed in in-place or reworked sandy sediments of the Camp Rice Formation (fluvial facies), which were deposited by the ancestral Rio Grande.

Torripsamments (Bluepoint and University soils) dominate many of the fans and terraces. Torriorthents (Kokan and Yturbide soils) dominate the structural bench on the west side of the valley. Arizo soils (Torriorthents) are not so steep as Kokan soils and occur on many of the Fillmore terraces along the arroyo channels. Very small areas of Haplocalcids (mostly Rilloso soils) are preserved on some of the high ridge crests.

No. 2. Rilloso, Caliza, and Yturbide soils (Typic Haplocalcids and Torriorthents).—These soils occur on dissected terrain west of the Dona Ana Mountains and along major arroyos in the southern part of the area. Most areas have been strongly dissected by arroyos; ridge remnants of alluvial fans and terraces, generally of Picacho age, are prominent in many places. Narrow Fillmore terraces are commonly inset against the ridge remnants. Nearest the valley, dissection has been so severe that the original depositional slope of the fans has been substantially altered and the Picacho surface has been replaced by the younger Fillmore surface. Saddles are common in such areas. Longitudinal slopes along ridge crests range from about 2 to 5 percent; slopes of ridge sides range from about 5 to 35 percent. The soils have formed mostly in igneous rocks from the mountains upslope, in places with contributions from the Camp Rice Formation.

Haplocalcids (mostly Rilloso and Caliza soils) dominate the ridge crests in the stabler areas. The calcic horizon of these soils has been truncated on very narrow ridges, and Torriorthents (commonly Kokan soils) occur on both the ridge crests and ridge sides. Torriorthents (mostly Arizo and Yturbide soils) dominate Fillmore terraces inset against the remnants. In a few places Calciargids and Argic Petrocalcids are preserved on the stablest parts of the Picacho surface.

No. 3. Tencee, Upton, Dalian, and Weiser soils (Calcic Petrocalcids, Typic Torriorthents, and Typic Haplocalcids).—These soils are east and south of the Robledo Mountains. In most places the area is characterized by high Picacho or Tortugas fan remnants that have been deeply dissected. Fillmore terraces are inset against the high fan remnants and are about 1 to several meters higher than the arroyo channels. Steep colluvial wedges occur on the sides of the remnants. The Fillmore sediments often coalesce to form small fans beyond the lower edges of the remnants. Small areas of the Leasburg surface occur in places and are intermediate in elevation between the Fillmore and Picacho surfaces. Longitudinal slopes range from 3 to 5 percent. Most side slopes along margins of the Picacho remnants range from about 25 to 50 percent; in places they are nearly vertical. The soils have formed in sediments derived mostly from calcareous sedimentary rocks, including limestone and sandstone.

Petrocalcids (Tencee and Upton soils) dominate the broad crests of the Picacho remnants. Haplocalcids (Weiser soils) occur on the Leasburg surface and on narrow Picacho remnants where the petrocalcic horizon has broken up because of landscape dissection and soil truncation. Torriorthents (mostly Dalian soils) dominate the Fillmore terraces and also the colluvial wedges of the sides of the Picacho remnants. Torrifluvents (mostly Glendale and Anthony soils) occur in low-gravel areas of Fillmore alluvium near the flood plain.

No. 4. Rotura-Bluepoint complex (Typic Petroargids and Torripsamments).—These soils are on the lower La Mesa, a relict basin floor west of the valley. Slopes are level or nearly level between coppice dunes, which are particularly prominent in the southern part of the unit. The soils formed in sediments of the Camp Rice Formation and in sandy sediments of coppice dunes.

Petroargids (Rotura soils) with deep petrocalcic horizons are dominant. Torripsamments (Bluepoint soils) occur on coppice dunes. Haplargids (Bucklebar and Sonoita soils) occur in pipes that penetrate the petrocalcic horizon of Rotura soils. Bucklebar soils also are in small depressions. Argic Petrocalcids (Cruces and Hueco soils) are on many slight ridges and in places around the periphery of the lower La Mesa.

No. 5. Tencee and Algerita soils (Typic Haplocalcids and Calcic Petrocalcids).—These soils occur along and near scarps bordering the La Mesa remnants west of the valley, near Goat Mountain, and north of Fort Selden. Slopes of ridge crests range from 1 to 5 percent towards the valley. Slopes of ridge sides range from about 10 to 40 percent. The soils have formed in sediments of the Camp Rice Formation (fluvial facies).

Calcic Petrocalcids (mostly Tencee soils and eroded phases) and Typic Haplocalcids are dominant. The Haplocalcids are mostly Algerita, Jal, and Weiser soils, their discontinuously cemented analogs, and eroded phases, in which the calcic horizon is at or very near the surface.

No. 6. Cruces soils (Argic Petrocalcids).—These soils occur on the upper La Mesa west of the valley, on the JER La Mesa north of Fort Selden, and on La Mesa near Goat Mountain. Slopes generally are level or nearly level, but part of the JER La Mesa slopes 1 to 3 percent to the north. The soils have formed in sediments of the Camp Rice Formation (fluvial facies) and in sediments of coppice dunes.

Argic Petrocalcids (mostly Cruces soils) are dominant. Torripsamments (Bluepoint soils) occur on coppice dunes. Haplargids and Calciargids (Bucklebar and Berino soils) occur in pipes that penetrate the petrocalcic horizon of the Petrocalcids. Rotura soils (Petroargids) occur where depth to the petrocalcic horizon is 100 to 150 cm.

No. 7. Caliza complex (Typic Haplocalcids, Torriorthents, and Torripsamments).—These soils are strongly dissected, and high, narrow ridges are prominent. A structural bench has formed on gravel-capped ridge crests, where saddles are common. The highest parts of the ridge crests are level or nearly level; locally, slopes along ridge crests range from 2 to 5 percent. Slopes of ridge sides range from 5 to 35 percent. The soils have formed in sediments of the Camp Rice Formation (fluvial facies).

Haplocalcids (Caliza and Rilloso soils) dominate the highest, stablest ridges of the structural bench; Torriorthents (Kokan and Yturbide soils) and Torripsamments (University soils) dominate the ridge sides. The eastern boundary of these soils on structural benches is marked by a sinuous scarp where the pebbles of the structural bench pass beneath alluvium derived from the Organ Mountains. The textural contrast between the gravelly structural bench and the finer textured, less gravelly alluvium from the Organs is responsible for the scarp.

No. 8. Nickel-Whitlock-Argids complex (Typic Haplocalcids and Calciargids).—Both the land surface and buried soils in this unit have been strongly dissected by erosion associated with downcutting of the Rio Grande Valley, and prominent ridges are the dominant landform. Longitudinal slopes along the ridge crest range from 1 to 2 percent; slopes of ridge sides range mostly from about 5 to 40 percent. The soils have formed in alluvium derived from monzonite, rhyolite, and andesite, with monzonite decreasing and rhyolite increasing southward.

The argillic horizon and the Argids are preserved at the stablest places in the center of some ridge crests, but in most places erosion associated with the dissection has stripped away the argillic horizon and the underlying calcic horizon becomes diagnostic for classification. The resultant soils are Haplocalcids (mostly Nickel and Whitlock soils). Buried soils commonly crop out on the sides of ridges.

No. 9. Bucklebar and Onite soils (Typic Haplargids).—These soils are on the Leasburg surface and are in one map unit in the vicinity of Fort Selden. Slopes range from level to 1 percent; most of the area is level. The soils have formed in materials of mixed lithology but generally with little or no carbonate.

Parts of the area are under cultivation. Fine-loamy Bucklebar soils occur in areas of finer texture; coarse-loamy Onite soils occur with facies changes to coarser texture.

The soils in this unit are not extensive, but their stage II carbonate constitutes an important morphological and chronological link between younger soils of the Fillmore surface, which have stage I carbonate, and older soils of the Picacho surface, which have stage III carbonate.

Minor areas of Haplocalcids (Nickel and Caliza soils) and Torriorthents (Arizo and Herbel soils) occur along the western margin of the unit.

No. 10. Rilloso and University soils (Typic Haplocalcids and Torripsamments).—These soils occur on the Picacho surface in the northwest part of the study area. Slopes range from 3 to 4 percent. The soils have formed in sandy sediments derived from the Camp Rice Formation.

Rilloso soils (Typic Haplocalcids) are dominant. They occur on the ridge crests of the Picacho remnants. Smaller areas of Yturbide and University soils (Typic Torripsamments) occur in narrow areas of Fillmore deposits between the ridge crests.

Soils of the Piedmont Slopes

The piedmont slopes extend from the valley border to the Organ Mountains in the southern part of the study area (fig. 3, table 2). To the north, the piedmont slopes extend from the basin floor north of Highway 70 to the San Andres and San Agustin Mountains on the east and to the Dona Ana Mountains on the west.

No. 11. Algerita complex (Typic Haplocalcids).—Ridges and intervening arroyos are prominent in this unit. Longitudinal slopes along the ridge crests range from 2 to 5 percent; transverse slopes of ridge sides range from about 5 to 35 percent. The highest ridges are Jornada I and are dissected most; the lower surfaces (Tortugas, Picacho, and Fillmore) are relatively stable and are less dissected. The soils have formed in alluvium derived mostly from monzonite, with smaller amounts from andesite and rhyolite.

In most places the sediments contain relatively few rock fragments so that even the oldest soils (Jornada I) lack petrocalcic horizons and are mostly Haplocalcids. Argids generally occur on the stabler Tortugas and Picacho surfaces, and the Fillmore surface has mostly Entisols or weak Haplargids or Haplocambids.

No. 12. Delnorte-Algerita complex (Typic Petrocalcids and Haplocalcids).—These soils occur just south of unit 11 and differ from soils of that unit in having more rock fragments and consequently more petrocalcic horizons. Long, east-west ridges are prominent. Longitudinal slopes along ridge crests range from about 3 percent nearest to the mountains to 2 percent in the western part of the unit. Slopes of ridge sides range from about 5 to 35 percent. The soils have formed in alluvium derived from monzonite, rhyolite, and andesite. Southward, monzonite sediments gradually decrease to zero and rhyolite increases greatly.

The Jornada I ridges are dominated by Petrocalcids (Delnorte soils), in places alternating with Haplocalcids (Algerita soils) where the sediments contain fewer rock fragments. Southward, the areas occupied by the Picacho (and to a lesser extent the Tortugas) surface become larger, so that some of the Jornada I ridges are widely separated from each other.

No. 13. Sonoita, Dona Ana, and Bluepoint soils (Typic Haplargids, Calciargids, and Torripsamments).—These soils occur in small areas east and southeast of Tortugas Mountain, north of Port Selden, and north of the Dona Ana Mountains. This unit has a variety of soils that apparently formed partly or wholly in sandy eolian sediments. Slopes range from level to 3 percent.

Bluepoint soils, the youngest soils, occur in areas of sandy sediments on coppice dunes. Sonoita, Dona Ana, and Hueco soils are progressively older.

No. 14. Hachita and Pinaleno soils (Argic Petrocalcids and Typic Calciargids).—These soils occur on the Jornada fan piedmont and also extend downslope, occurring on narrow valley-border terraces between high ridges. Slopes range from 4 percent at the higher elevations to 2 percent at the lower elevations. The soils have formed in alluvium derived almost wholly from rhyolite; in places there are small amounts of andesite.

Argic Petrocalcids (Hachita soils) dominate the Jornada II fan piedmont, in places grading to Typic Calciargids (Pinaleno soils) where the soils have a calcic horizon. In downslope areas where the soils occur on terraces inset against higher ridges, the soils are Calciargids (mostly Pinaleno soils) and Typic Petrocalcids (Delnorte soils).

No. 15. Soledad-Onite complex (Typic Haplargids).—These soils occur on scattered fans of Organ age that bury older soils of the Jornada fan-piedmont. Slopes range from 3 to 5 percent. The soils have formed in alluvium derived mostly or wholly from rhyolite.

The loamy-skeletal Soledad soils are dominant. Onite soils occur in areas of facies changes to nonskeletal soils.

No. 16. Terino, Terino analog, Boracho, and Caralampi soils (Ustalfic Petrocalcids, Petrocalcic Calciustolls, and Ustic Haplargids).—The soils have formed in rhyolitic alluvium. They occur mostly on the Jornada, Dona Ana, and Organ surfaces and range widely in age. The fans have been deeply dissected by arroyos. The area includes high, narrow ridges of the Dona Ana surface, the lower Jornada terraces (some of which have been relatively little altered by dissection), and still lower terraces of the Organ surface. Slopes along the ridge crests range from about 10 percent nearest the mountains to 4 percent in the western part of the unit. Most slopes of ridge sides range from about 15 to 50 percent.

Ustic Haplargids (Caralampi soils), Ustalfic Petrocalcids, and Ustic Petroargids (Terino soils and analogs) dominate the stabler areas of the Jornada surface. Haplustolls (Baylor and Santo Tomas soils) and Argiustolls (Earp soils) occur mostly on the Organ terraces. In areas of the Dona Ana surface, ridge sides are younger than Dona Ana ridge crests, ranging from Jornada to Organ in age. Because of this variety and the effects of slope and aspect on soil morphology, the soil patterns are extremely complex. A small, but highly significant remnant of the Dona Ana surface is preserved in a bedrock-defended area in Ice Canyon, at the highest elevations in this unit. Consult Gile et al. (1995b) for a detailed soil map of this important area; soils of this remnant are not known to exist elsewhere in the Desert Project. Ustalfic Petrocalcids (Hayner soils and analogs) dominate the relatively stable ridge crest in this area. Ustic Haplargids (Eloma soils and analogs) dominate the ridge sides. On the Dona Ana surface west of Ice Canyon, Terino soils occur in the stabler areas; Petrocalcic Calciustolls (Boracho soils) occur in the less stable areas where the argillic horizon does not occur. Ustic Petrocalcids (Monterosa soils) occur in places where the epipedon does not qualify as mollic, mostly on some south-facing slopes, particularly at the lower elevations.

No. 17. Baylor, Santo Tomas, and Earp soils (Torriorthentic Haplustolls and Aridic Argiustolls).— These soils occur west of the southern part of the Organ Mountains, on fans and terraces of Organ age. Slopes range from 4 to 10 percent. The soils have formed in sediments derived mostly from rhyolite. They are mostly Baylor soils (Torriorthentic Haplustolls), Santo Tomas soils (Pachic Haplustolls), and Earp soils (Aridic Argiustolls). The Earp soils occur on the older parts of the Organ landscape where an argillic horizon has formed.

No. 18. Caralampi complex (Ustic Haplargids and Calciargids and Ustalfic Petrocalcids).—These soils occur along the front of the Organ Mountains, directly north of unit 16. The soils occur on high fans extending westward from the mountain canyons and on terraces between the fans. Slopes generally range from about 5 to 15 percent, in places reaching 40 percent on sides of ridges at the highest elevations. The soils have formed in alluvium derived mostly from monzonite and rhyolite; calcareous sedimentary rocks contribute alluvium in a few areas.

Ustic Calciargids (Nolam soils) and Haplargids (Caralampi soils) are dominant on the Jornada fans, and Ustalfic Petrocalcids (Terino soils) occur where a horizons, and the older soils of the Jornada II surface, which have prominent stage III horizons. The coarse-loamy Yucca soils have less than 18 percent clay in the fine-earth fraction and illustrate initial development of both the calcic horizon and the Yucca series. Very minor areas of Bluepoint soils (Typic Torripsamments) and Amole soils (Typic Torriorthents) occur on the Isaacks' Ranch ridge. Both soils have Bt horizons that are too coarse-textured for a cambic horizon and have too little clay increase for an argillic horizon.

No. 22. Delnorte very gravelly sandy loam (Typic Petrocalcids).—These soils occur on small, isolated Jornada I and pre-Jornada I fan remnants west of the Organ Mountains and rhyolite parts of Quartzite Mountain. Slopes along ridge crests of the remnants range from 3 to 15 percent; slopes along ridge sides range from 10 to 25 percent. The soils have formed in alluvium derived mostly from rhyolite and/or monzonite, in places with minor amounts of sedimentary rocks.

Typic Petrocalcids (Delnorte soils) are dominant; Simona soils occur in areas of the less gravelly materials. Argids (mostly Hachita soils) occur in minor areas where an argillic horizon is still preserved.

No. 23. Summerford, Onate, and Aladdin soils (Ustic Haplargids, Aridic Argiustolls, and Typic Haplustolls).—There are two delineations of this unit, one in the vicinity of Organ Mountains and the other around Summerford Mountain. These soils occur on Organ fans that extend downslope from the mountains. Slopes range from about 4 to 13 percent in the Organ area and from about 7 to 10 percent in the Summerford Mountain area. The soils have formed in sediments derived from monzonite.

Ustic Haplargids (the Summerford soil and its analog) tend to dominate the Organ fans around Summerford Mountain, with fewer Argiustolls and Haplustolls. In contrast, Onate and Aladdin soils tend to dominate the area in the vicinity of Organ, occurring mostly at the higher elevations in the central to eastern part of the unit. Most soils are gravelly, but not skeletal; generally, the gravel is fine or medium in size.

No. 24. Tencee, Upton, and Jal soils (Calcic Petrocalcids and Typic Haplocalcids).—These soils occur on Jornada fans west of the San Andres and San Agustin Mountains. Slopes range from 2 percent at the lower elevations to 6 percent near the mountains. The soils have formed in alluvium derived from limestone, sandstone, siltstone, and shale, generally with additions of rhyolite, andesite, and/or quartzite.

Petrocalcids (mostly Tencee and Upton soils) are dominant. Haplocalcids (mainly Jal soils) occur in the less gravelly areas where a petrocalcic horizon has not formed.

No. 25. Tencee, Boracho analog, and Kimbrough soils (Petrocalcic Calciustolls and Calcic Petrocalcids).—These soils occur on ridge remnants of Jornada fans in two areas (one west of Bear Canyon and the other west of Hawkeye Canyon) and on narrow Organ terraces between the ridges. Slopes range from 3 to 8 percent along ridge crests and from 10 to 25 percent on ridge sides. The soils have formed in sediments derived mostly from sedimentary rocks—limestone, siltstone, sandstone, and shale, commonly with additions from igneous rocks, such as rhyolite, granite, and monzonite.

Boracho analog and Kimbrough soils (both Petrocalcic Calciustolls) occur in the highest, stablest parts of the unit, and Tencee and Upton soils (Calcic Petrocalcids) occur at the lower elevations. Calcareous analogs of Baylor and Santo Tomas soils (both Haplustolls), Dalian soils and their analog, and Herbel soils (all Torriorthents) occur on the Organ terraces.

No. 26. Herbel and Anthony soils (Typic Torriorthents and Torrifluvents).—These soils occur west of the San Andres and San Agustin Mountains, on fans and terraces of Organ and Isaacks' Ranch age.

Slopes range from 2 to 6 percent. The soils have formed in alluvium derived partly or mostly from sedimentary rocks—limestone, sandstone, siltstone, and shale, commonly with additions from rhyolite, andesite, and/or quartzite. No argillic horizons occur in this unit because enough carbonate is in the parent materials to preclude the formation of an argillic horizon in soils this young.

The Typic Torriorthents (Herbel soils) are dominant. Primarily because of variations in texture and age, this unit has a wide variety of other soils. Some soils (such as Anthony soils) are Torrifluvents because medium or moderately fine textured horizons are at relatively shallow depths and are overlain by coarser textured materials, causing an irregular decrease in content of organic carbon with depth. Horizons in other soils of early Organ or Isaacks' Ranch age have enough carbonate to qualify as calcic horizons because high-carbonate sediments are in the parent materials. These soils (mostly Nickel and Caliza soils) are Typic Haplocalcids. Typic Torriorthents (Arizo soils) and Typic Torripsamments (Yturbide soils) occur in places.

No. 27. Reagan-Glendale complex (Typic and Ustic Torrifluvents and Haplocalcids).—These soils occur in broad, sheetlike deposits of Organ age west of the San Andres Mountains. Slopes range from 1 to 2 percent. The soils have formed in alluvium derived mostly from sedimentary rocks—limestone, siltstone, sandstone, and shale, commonly with additions from such rocks as rhyolite, andesite, and quartzite.

No argillic horizon has formed in these soils of Organ age because the materials contain too much carbonate for one to form in soils this young. Weak calcic horizons, however, have formed in some soils of Organ I age. Thus, all soils are either Entisols or weak Haplocalcids. For example, the Reagan and Crowflats soils are Ustic Haplocalcids and Torrifluvents, respectively. These soils occur in grassy areas where moisture infiltration is much greater than in the barren areas where Glendale and Reakor soils (Typic Torrifluvents and Haplocalcids, respectively) occur.

No. 28. Headquarters complex (Ustic and Typic Calciargids and Ustic Haplocalcids).—These soils are on the Jornada fan piedmont directly north of unit 20. The boundary between the two units is caused by a change to high-carbonate parent materials in unit 28. Slopes range from 2 percent at the higher elevations to 1 percent near the basin floor. The soils have formed in alluvium derived mainly from limestone, sandstone, siltstone, and shale, commonly with additions of rhyolite and/or quartzite.

These soils illustrate the sporadic occurrence of the argillic horizon that results partly from variations in carbonate content of the alluvium; the argillic horizon formed where the carbonate content of the alluvium was sufficiently low. In other places the argillic horizon formed and was later eroded away, as is shown by exposures along scarps. The Ustic and Typic Calciargids (Headquarters and Dona Ana soils) occur where the argillic horizon formed and was not later eroded away; the Ustic and Typic Haplocalcids (Chispa and Jal soils, respectively) occur where no argillic horizon is evident.

No. 29. Jal sandy loam (Typic Haplocalcids).—These soils occur mainly west of the San Andres Mountains, with small areas near the Dona Ana Mountains and Tortugas Mountain. Most slopes range from 1 to 2 percent. The soils formed in alluvium derived mostly from limestone, siltstone, shale, and sandstone; in places, rhyolite, monzonite, and andesite are in the sediments. The soils are mostly the Typic Haplocalcids (Jal soils), in places with inclusions of Calciargids, Petrocalcids, Torrifluvents, and Torriorthents.

No. 30. Dona Ana soils (Typic Calciargids and Typic and Ustic Haplocalcids).—These soils occur in one area west of the San Andres Mountains, on the lower slopes of the Jornada fan piedmont. Slope is 1 percent to the west. The soils have formed in sediments derived mostly from sedimentary rocks—limestone, calcareous sandstone, siltstone, and shale, with lesser amounts of granite, quartzite, andesite, and rhyolite.

This unit illustrates Pleistocene soils that have argillic horizons despite having formed in high-carbonate parent materials; these are the Typic Calciargids (Dona Ana soils). Typic and Ustic Haplocalcids (Jal and Chispa soils, respectively) occur where an argillic horizon has not formed. If soils of this unit had very high percentages of limestone fragments, the argillic horizon would not have formed at all, as is illustrated by the Tencee and Upton soils of the same age along the valley border.

No. 31. Dona Ana sandy loam (Typic Calciargids).—These soils occur in large areas of the Jornada II surface east of the Dona Ana Mountains. Slopes range from 1 to 2 percent to the east. The soils have formed in alluvium derived from rhyolite, monzonite, andesite, and latite; in places there are small amounts of sedimentary rocks in the alluvium.

The Typic Calciargids (Dona Ana soils) are dominant. Also occurring are the Typic Calciargids (Berino soils) that lack macroscopic carbonate throughout the Bt horizon and Hap and Tres Hermanos soils, which average 15 to 35 percent gravel in their control sections.

No. 32. Herbel and Onite soils (Typic Torriorthents and Haplargids).—These soils occur in several areas east of the Dona Ana Mountains. Slopes range from 2 to 4 percent. The soils have formed in sediments derived from monzonite, rhyolite, andesite, and latite.

Most soils occur on the Organ fan piedmont, but some soils of Jornada age are at or very near the surface because most Organ sediments tend to be relatively thin downslope from the Dona Ana Mountains. Thus, a number of soils are “overwash phases” of buried soils, mostly Tres Hermanos soils (Typic Calciargids). Where the Organ deposits are thicker, Onite soils (Typic Haplargids) occur if the soils have an argillic horizon. Herbel soils (Typic Torriorthents) dominate areas with no argillic horizon.

No. 33. Hachita, Casito, Delnorte, and Nickel soils (Argic Petrocalcids and Typic Haplocalcids and Petrocalcids).—These soils occur on the upper slopes of the broad Jornada fan piedmont east of the Dona Ana Mountains and south of Summerford Mountain. Slopes range from 3 to 7 percent. The soils have formed in sediments derived from rhyolite, andesite, monzonite, and latite.

Argic Petrocalcids (Hachita and Casito soils) occur on the stablest landscapes where the argillic horizon is still preserved. Typic Petrocalcids and Haplocalcids (Delnorte and Nickel soils) are most common on narrow ridges and occur where the argillic horizon has been eroded away, obliterated by soil fauna, and/or engulfed by carbonate. Typic Calciargids (Pinaleno soils) occur where a calcic horizon rather than a petrocalcic horizon has formed. Typic Haplargids (Soledad soils) and Torriorthents (Herbel soils) occur in minor areas of Organ sediments.

No. 34. Whitlock and Rilloso soils (Typic Haplocalcids).—These soils are of Jornada II age and occur downslope of Summerford Mountain. Slopes range from 3 to 5 percent. The soils have formed in alluvium derived from monzonite.

The Typic Haplocalcids (coarse-loamy Whitlock and sandy Rilloso soils) are dominant. Minor areas of Dona Ana and Hap soils, both Typic Haplargids, occur where an argillic horizon has been preserved.

Soils of the Basin Floor North of Highway 70

This section includes soils of the level basin floor and the adjacent fan toeslopes that slope 1/2 percent or less (fig. 3, table 2). Soils of unit 35 have formed in high-carbonate materials; the other soils have formed in low-carbonate parent materials.

No. 35. Reagan clay loam (Ustic Haplocalcids).—These soils occur northeast of Isaacks' Lake Playa. Slopes range from level in the western part of the unit to 1/2 percent in the eastern part. The soils have formed in nongravelly sediments with substantial amounts of silt and clay. The sediments were derived mainly from limestone, calcareous sandstone, siltstone, and shale, with smaller amounts of rhyolite, andesite, and granite.

Reagan soils (Ustic Haplocalcids) are dominant. Reakor soils (Typic Haplocalcids) occur in barren areas where soil moisture is less than on the grassy Reagan soils.

No. 36. Algerita and Chispa soils (Typic and Ustic Haplocalcids).—These soils occur on the northern part of the basin floor north of Highway 70. Broad, slight ridges and intervening slight depressions are typical of this unit. The depressions are level and the ridges slope 1 percent or less into the depressions. The soils have formed in the sand and mixed rounded gravel of the Camp Rice Formation (fluvial facies).

Algerita soils (Typic Haplocalcids) are dominant. Chispa soils (Ustic Haplocalcids) occur in the lowest part of the depressions and along margins of the adjacent toeslopes of the fan piedmont.

No. 37. Stellar-Continental complex (Ustic and Typic Calciargids).—These soils occur on Jornada I fan toeslopes east of the Dona Ana Mountains and on the level basin floor adjacent to the toeslopes. Prominent, alternating barren and vegetated strips are common at right angles to the slope. Slopes range from level on the basin floor to 1/2 percent on fan toeslopes adjacent to the level basin floor. The soils have formed in alluvium derived mostly from rhyolite, monzonite, andesite, and latite.

The Ustic Calciargids (Stellar soils) are in grassy areas that commonly occur as grassy strips. These soils have high infiltration rates and have more soil moisture than the Typic Calciargids. The Typic Calciargids (Continental soils) occur in areas with little or no grass, commonly in barren strips where moisture infiltration is much less than in the grassy areas.

No. 38. Dalby clay (Chromic Haplotorrerts).—These soils occur in two areas, one in and adjacent to Isaacks' Lake Playa and the other in a small playa east of the NMSU Ranch Headquarters. The areas are level. The soils have formed in sediments derived mostly from monzonite, rhyolite, and andesite.

This unit consists largely of Chromic Haplotorrerts (the Dalby taxadjunct), which dominate the main part of the playa. Less clayey Ustic Haplargids and Calciargids dominate the outer margins of the playa.

No. 39. Tencee, Simona, Cacique, and Cacique analog soils (Typic, Argic, and Ustalfic Petrocalcids).—These soils occur on the JER La Mesa basin floor and an adjacent scarp, east and northeast of Goat Mountain. The soils of the basin floor are level or nearly level; slopes of about 2 percent lead to the adjacent scarp. The soils have formed in the sand and gravel of the Camp Rice Formation (fluvial facies).

Tencee and Simona soils occur on the slight ridges of the basin floor, along the scarp and the slopes leading to it. Cacique and Hueco analogs occur in grassy depressions between the ridges. Cacique, Hueco, and Rotura analog soils occur on the nearly level basin floor that lacks the grassy depressions.

Repeat Photography

Repeat photography is a procedure whereby photographed sites are photographed later to illustrate changes (in such features as vegetation, landscapes, and soils) that have taken place since the site was first photographed. Rogers et al. (1984) present a bibliography about repeat photography. A number of publications have documented vegetation change with time (e.g., Hastings and Turner, 1965; Rogers, 1982; Stephens and Shoemaker, 1987; Webb, 1996), in which the first photography dates mostly or wholly from the 1800s. However, significant changes in vegetation can also be documented over a much shorter period of time. The purpose of this section is to illustrate some of the major vegetation changes that have occurred in the last 20 to 80 years, as shown by seven sites (fig. 4), six of which are in the arid zone. In the arid zone, two sites illustrate the disappearance of black grama and the associated

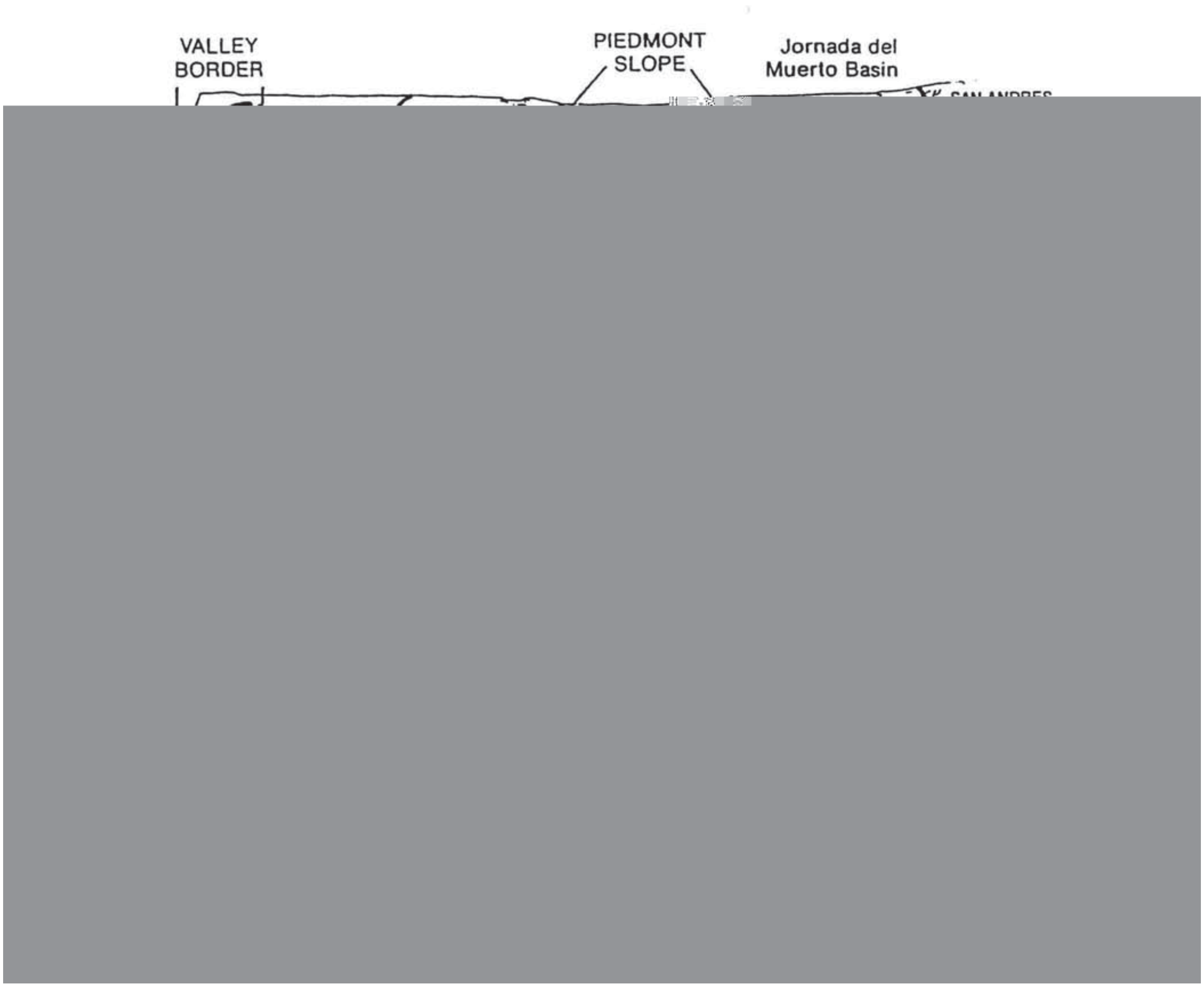

Figure 4.—Location of repeat photography sites: 1) the black grama exclosure; 2) north of the Dona Ana exclosure; 3) the Isaacks' radiocarbon site; 4) the Typic Haplocalcid, Whitlock 60-2; 5) the Typic Petrocalcid, Delnorte 66-2; 6) the Typic Haplargid, Onite; 7) the Ustalfic Petrocalcid, Hayner 60-5, in Ice Canyon.

expansion of shrubs; one illustrates both the persistence of black grama and the spread of shrubs; and three document the expansion of shrubs in areas without black grama. The semiarid site illustrates substantial expansion of shrubs in an area where black grama is still evident.

The main vegetative types involved in or associated with the changes are black grama (*Bouteloua eriopoda*), creosotebush (*Larrea tridentata*), snakeweed (*Gutierrezia sarothrae*), Mormon tea (*Ephedra Torreyana*), mesquite (*Prosopis juliflora*), bush muhly (*Muhlenbergia porteri*), fluffgrass (*Tridens pulchellus*), ratany (*Krameria parvifolia*), dropseed (*Sporobolus* sp.), soaptree yucca (*Yucca elata*), four-wing saltbush (*Atriplex canescens*), six-weeks grama (*Bouteloua barbata*), whitethorn (*Acacia constricta*), and *Yucca baccata*.

Black Grama

Black grama is one of the major grasses for grazing in this area. Buffington and Herbel (1965) present evidence of the increase of shrubs and the decrease of grasses (see coppice dunes section). Herbel et al. (1972) show a substantial reduction of black grama in the Jornada Experimental Range resulting from the great drought of 1951-1956. Two sites, a black grama exclosure east of Las Cruces and an area north of the Dona Ana exclosure (fig. 4), illustrate loss of black grama. One site, the Isaacks' radiocarbon site discussed later, illustrates an area where black grama is still evident.

The Black Grama Exclosure

The black grama exclosure (figs. 5, 6, and 7) was constructed by SCS in 1937 after work by the Civilian Conservation Corps (CCC) in 1935 and 1936. One of the CCC camps was in Las Cruces (Helms, 1985; the Las Cruces Sun-News, November 24, 1991, p. 1; the Las Cruces Bulletin, January 16, 1992, p. A-6). Much of the CCC work involved the construction of dams, contour furrows, and strips of rock fragments, here termed rock strips, to retard erosion. Many of these features are distinct in aerial photographs taken on December 16, 1936. The exclosure is best shown in 1" = 200' aerial photographs taken in the U.S. Highway 70 Reliever Routes study in January 1988.

Vegetation Inside vs. Outside the Exclosure

The present contrast between vegetation inside vs. outside the exclosure is shown by figure 5. Black grama is thriving in many places inside the exclosure, where it is protected from grazing, but it is absent or very sparse outside the exclosure. The great drought of 1951-1956 (Herbel et al., 1972) may have been a contributing factor, along with heavy grazing, to the decline of black grama outside the exclosure. Protection from overgrazing is also thought to have been a factor in preservation of a black grama stand at the Isaacks' radiocarbon site, which will be discussed later.

Changes Inside the Exclosure

One of the Desert Project dust traps was placed in the exclosure in 1962; figures 6 and 7 show the condition of vegetation in 1962 and in 2000, nearly 40 years later. Distinct differences are apparent (see legends for figs. 6 and 7). Prominent penetrations of mesquite inside the exclosure (fig. 7) show that mesquite can spread into black grama stands without the droppings of cattle, which are a major factor in the spread of mesquite (Buffington and Herbel, 1965). In addition to mesquite, other shrubs have also changed (see legend for fig. 7).

Changes Outside the Exclosure

Significant changes have also taken place outside the exclosure. These are illustrated by figures 8 and 9, directly west of the exclosure, and figures 10 to 12, directly east of it. Figures 8 and 9 illustrate a rock strip, constructed by the CCC, across a small drainageway directly west of the exclosure. The photographs, taken in 1961 and 2000, demonstrate substantial introduction and growth of mesquite in and near the drainageway.

Figures 10, 11, and 12 are photographs taken in 1946, 1961, and 2000, respectively, in and adjacent to a small drainageway directly east of the exclosure. The photographs record the disappearance of black grama, extensive invasion by shrubs, especially mesquite, and the enlargement and increasing numbers of other shrubs, such as snakeweed and Mormon tea.

South of the drainageway just discussed, 1961 and 2000 photographs (figs. 13 and 14) provide a view of the exclosure from its east fence. Grasses were much more extensive inside the enclosure in 2000 than in 1961. The sparsity of grasses in 1961 may have been the result of the great drought of 1951-1956, and the thicker grasses in 2000 may have been the result of times of better moisture since 1961. Figures 13 and 14 also show the east fence of a smaller exclosure (inside the main one), which will be discussed next.

A Small Exclosure Inside the Main Exclosure

Figure 15 is a closer view of a small exclosure in the southwestern part of the main exclosure. The small exclosure has a fine mesh metal strip, topped with a solid metal strip about a foot thick, that separates the small exclosure from the main one. In many places the top metal strip has fallen down since 1961 (figs. 13, 14, and 15). Presumably, this type of fence was intended to keep rodents out. Black grama inside this smaller exclosure is thicker and more continuous than in the main exclosure. Also occurring inside the small exclosure are several large mesquite plants and scattered Mormon tea.

Figure 16 shows the vegetation along and near the north boundary of the small exclosure. A thick grassy cover extends across the boundary into the main exclosure, apparently because of a drainageway where extra moisture is available. In drainageways outside the exclosure, on the other hand, substantial erosion has taken place and grass is sparse or absent.

Conditions in March 2001

Observations in March 2001 show that the exclosure no longer keeps cattle out. An open gate in the south fence and fresh cattle tracks and manure show that the exclosure has been penetrated. The gate appears to have been open for some time, but evidence of penetration was not observed in earlier visits because of the dense vegetation and lack of evidence of recent grazing inside the exclosure. In March 2001, vegetation in the exclosure near the open gate consisted of grazed-off clumps of black grama, snakeweed, Mormon tea, mesquite, bush muhly, and fluffgrass and a single *Yucca baccata* plant about 7 feet tall and 4 feet in diameter at its widest point. There was still more grass inside the exclosure than outside, but the difference was less obvious in March 2000 because the grass inside was very thick then, with no evidence of recent grazing.

Even the innermost, smaller exclosure that once had the continuous metal strip at the top had been breached by cattle in 2001. The grass in it had been heavily grazed, and fresh cattle tracks and manure were evident. The penetration apparently took place on the north side of the exclosure where the metal strip at top was down. The fine-meshed fence beneath was only about 1$^1/_2$ feet high and was readily crossed by cattle, as was shown by fresh tracks on both sides. Grass in that area had been heavily grazed, and the area looked much different than in March 2000, when it had the dense, grassy cover shown by photographs taken then.

Figure 5.— View along the west fence line, looking north. Black grama is abundant inside the exclosure but generally does not occur outside it. Mesquite is outside and inside the exclosure. Outside the exclosure, mesquite is often accompanied by bush muhly. Photographed in February 2000.

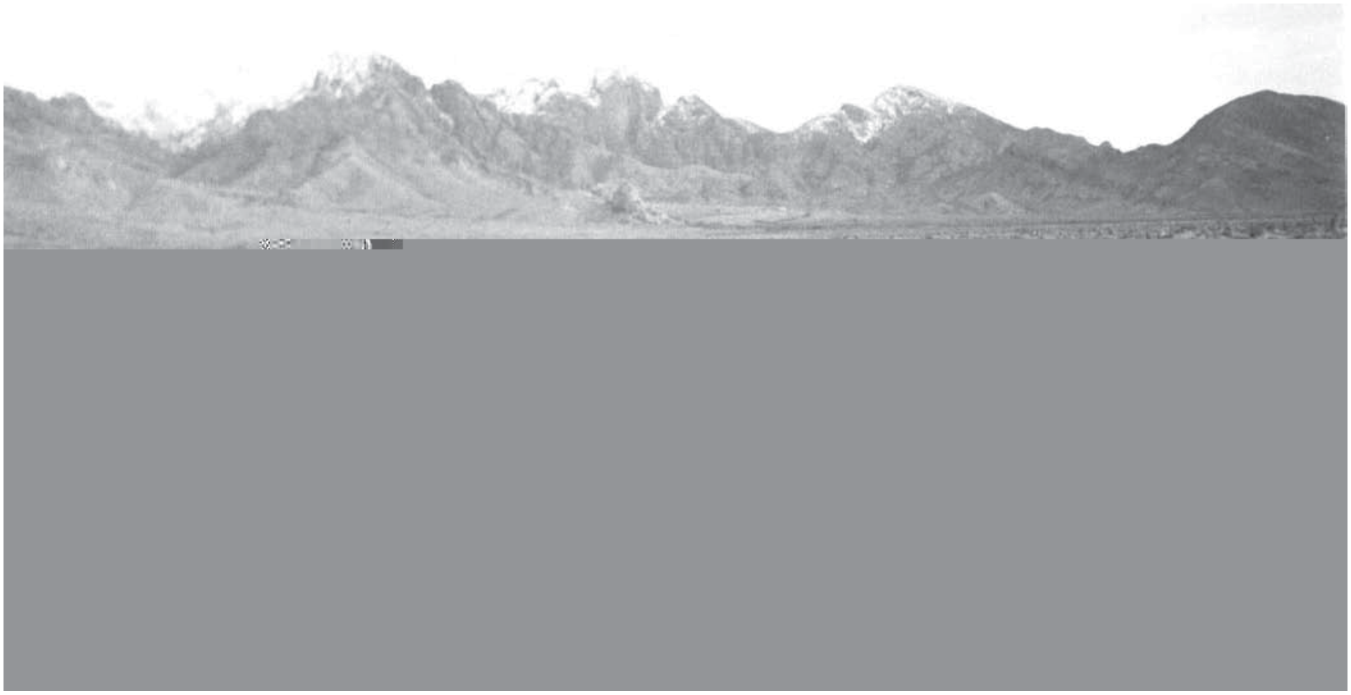

Figure 6.—A 1962 photograph of the inside northwest corner of the black grama exclosure. Black grama is common. No mesquite shrubs are evident, but a few Mormon tea and snakeweed plants and clumps of fluffgrass are evident. One of the Desert Project dust traps is at right center.

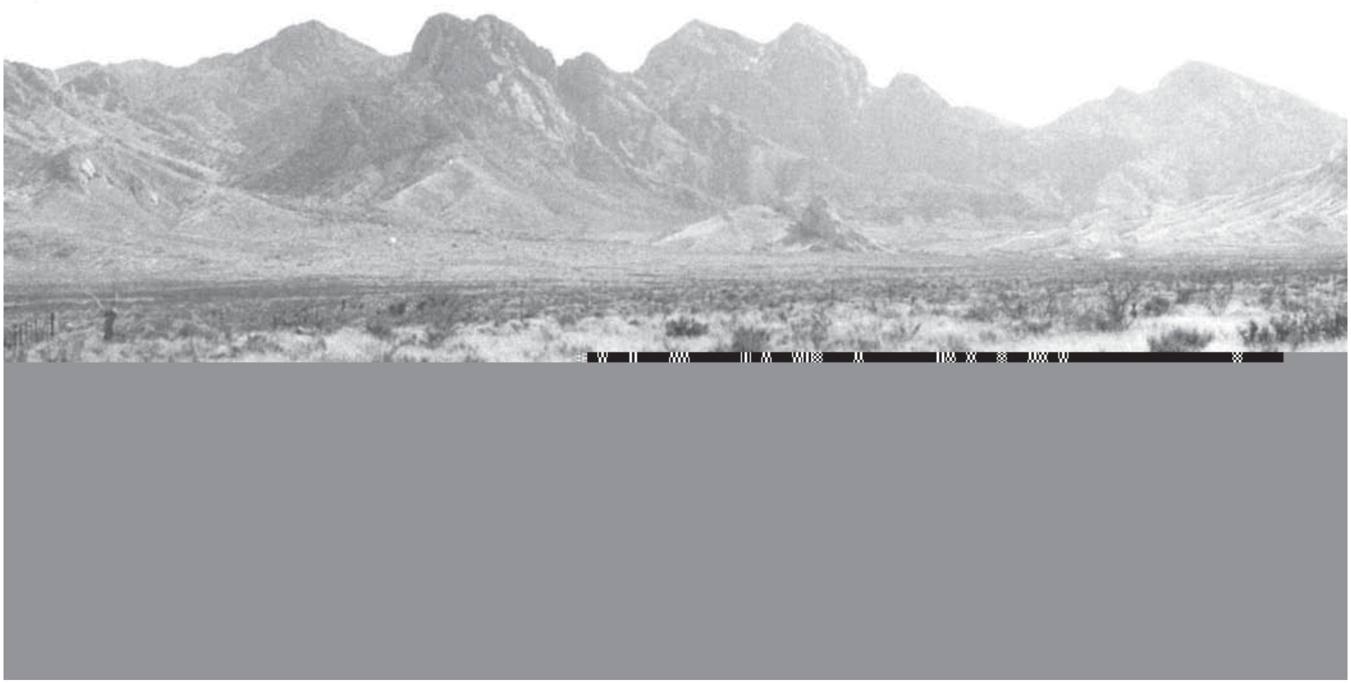

Figure 7.—Photograph of the same area inside the black grama exclosure in February 2000. Black grama is abundant. In contrast to 1962, mesquite is now clearly evident, several large clumps occurring just this side of the dust trap as well as south of it. Mormon tea and snakeweed are larger and more numerous now than in 1962. No leaves are evident on the mesquite because the photographs were taken in the winter, when the leaves are off.

Figure 8. —A 1961 photograph of a rock strip, foreground, and the west fence of the exclosure, middle ground. The Organ Mountains are on the skyline. Photographed by J.L. Gardner.

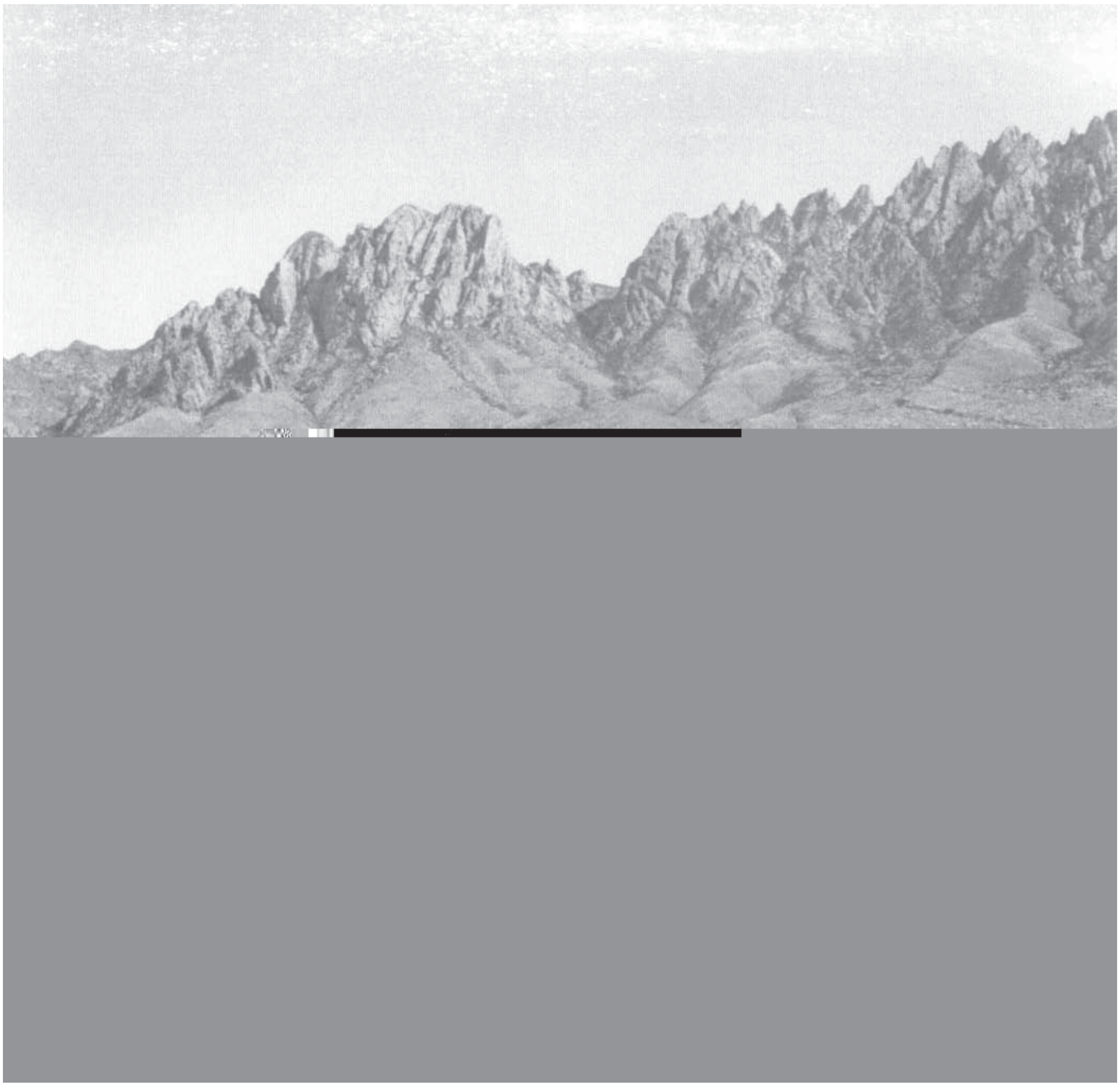

Figure 9. —Photograph of the same rock strip and fence in February 2000. Note key cobbles for identification in the strip of rock fragments and at left, directly west of it. The small stone directly east of the strip was covered by snakeweed in the 1961 photograph. Much of the snakeweed has been replaced by mesquite. Black grama, although generally absent, is growing between some of the cobbles, where moisture conditions are better than in areas with no rock fragments, a common situation in areas with sporadic concentrations of rock fragments and a general sparsity of grasses.

Figure 10.—A 1946 photograph of a drainageway just upslope (east) of the exclosure. Vegetation consists of Mormon tea, snakeweed, unidentified shrubs, and scattered clumps of black grama in and adjacent to the drainageway. Photographed by J.L. Gardner.

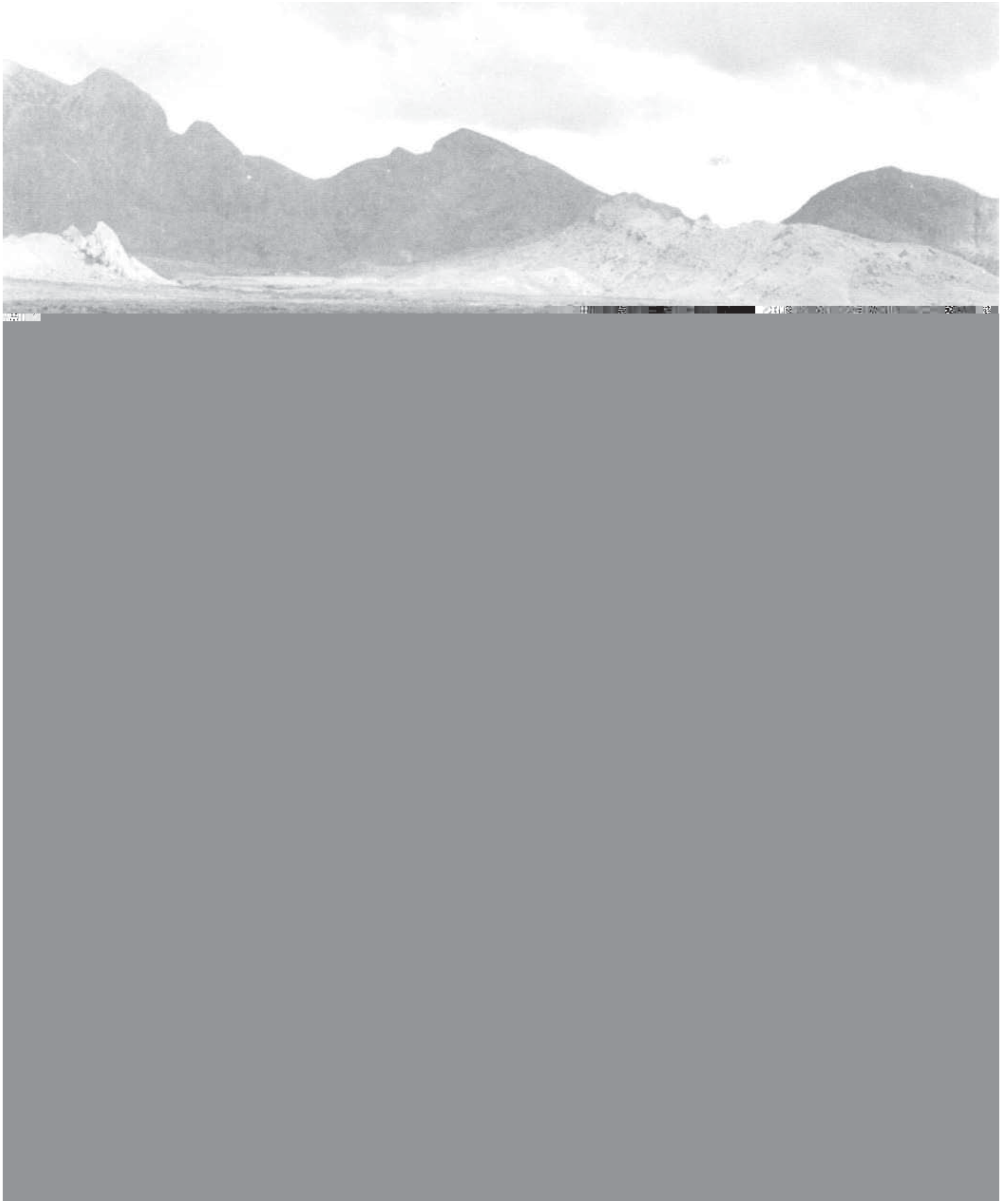

Figure 11. —The drainageway upslope of the exclosure in 1961. Vegetation consists of snakeweed, Mormon tea, and a few clumps of fluffgrass. In contrast to 1941, there is no black grama. Photographed by J.L. Gardner.

Figure 12. —The drainageway upslope of the exclosure in March 2000. Aggradation in the channel has made the drainageway less obvious than in 1946 and 1961. The Mormon tea at the lower center has enlarged, as has the snakeweed. The bend in the channel is marked by a prominent mesquite (directly north of it) that is not evident in the earlier photographs. Other vegetation consists of fluffgrass, six-weeks grama, and bush muhly around some of the mesquite and Mormon tea.

Figure 13.—A 1961 photograph from the east fence of the main exclosure, looking west. The dark bank that extends from the center background to the right is the top of a fence around a small exclosure inside the main one. Photographed by J.L. Gardner.

Figure 14.—The same area shown in figure 13, photographed in March 2000. The metal strip atop the fence of the small exclosure has fallen down in many places. The drainageway at the center bottom in figure 13 has aggraded. Grasses are much denser inside the exclosure than in 1961, and a *Yucca baccata* shrub is evident at the left.

Figure 15.—Boundary between the main exclosure, at left, and the inner exclosure, at right. Black grama is much thicker inside the inner exclosure than in the main exclosure. The shrubs in the inner exclosure are Mormon tea. The Robledo Mountains are on the skyline at center. Photographed in March 2000.

Figure 16.—Boundary between the main exclosure, at right, and the small exclosure, at left. Because of the extra moisture provided by a drainageway, the thick grassy cover extends across the fence from the small to the main exclosure. A large mesquite is in the right foreground. Photographed in March 2000.

Black Grama North of the Dona Ana Exclosure

The Dona Ana exclosure was established by the Jornada Experimental Range as a black grama clipping study (see Herbel et al., 1994, for a discussion of soils and soil moisture at this exclosure). Vegetation records indicate that this site was dominated by black grama in 1915 (Buffington and Herbel, 1965). The black grama has since disappeared, and the present vegetation is dominated by creosotebush, tarbush, a few soaptree yucca plants, and scattered clumps of bush muhly, dropseed, snakeweed, and fluffgrass; there are many barren areas throughout the exclosure.

Buffington and Herbel (1965, figure 11A) show a 1920 photograph (fig. 17) of black grama north of the exclosure; a 1991 photograph of the same area is shown in figure 18. The vegetation change was so prominent that it was pointed out at tours of the Jornada Experimental Range in the 1960s.

Black Grama Near the Isaacks' Radiocarbon Site

This site is study area 10b of the Desert Project guidebook (Gile et al., 1981, 1995b). Vegetation at area 10b is dominated by black grama, which is of interest because it is still preserved in an area that generally lacks it. Lack of or a minimum of overgrazing may be a factor in this preservation. The area is in the easternmost part of state-owned land leased by a rancher. It is less accessible to cattle than areas closer to the ranch buildings and could have been grazed less intensively.

Study area 10b is on a ridge crest of the late Jornada II surface (table 1) and is dominated by Typic Calciargids (Yucca soils). This pit is in the broadest part of the ridge crest, where pipes are well developed (figs. 19 and 20). Photographs of this area were taken after the study trenches were dug for field study tours in 1971 and 2000. Although the black grama looked somewhat sparse in the 1971 photograph (fig. 19), this grass has substantial ability to recover after times of stress.

The actual growth and spread of new black grama plants during the period from 1971 to 1988 was shown by its spread into the fill material of the 1971 trench. In addition, a good cover of black grama was on the ridge crest as a whole in 1988 (see the Isaacks' radiocarbon site, discussed later). Although black grama was still the dominant vegetation at area 10b in 2000, shrubs had definitely encroached onto the area; there were more soaptree yucca and cholla cactus and a few

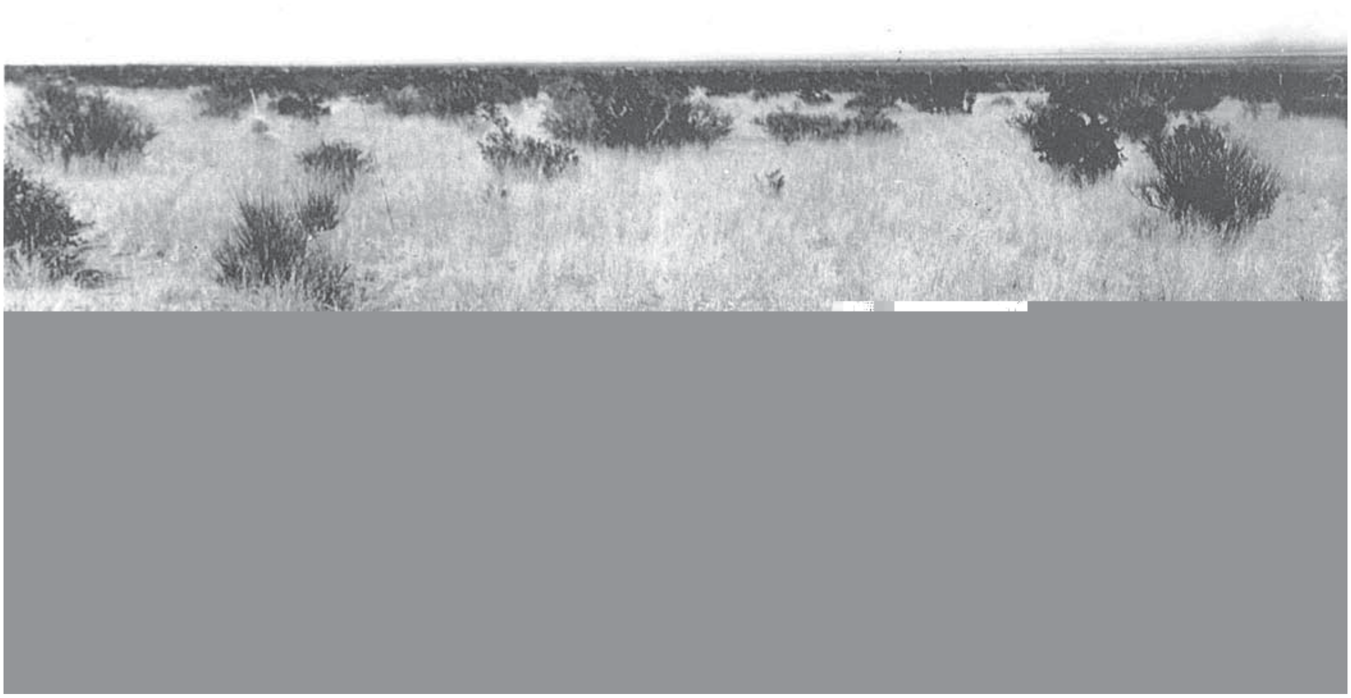

Figure 17.—A 1920 photograph of a black grama area just north of the Dona Ana exclosure (fig. 4), which was established in 1912 as a black grama clipping study. Mesquite and creosotebush shrubs also were evident.

creosotebush and mesquite plants. One mesquite, about 4 feet high, was directly north of the east end of the trench. East along the ridge crest, in 1971 no shrubs were evident; but in 2000, small Mormon tea, cholla cactus, and creosotebush had invaded the ridge crest from the west, south, and north. Farther east, a few tarbush plants were evident near the north-south road (Moongate Road).

Black grama also occurs at study area 10a, the charcoal-dated site. (See photograph at the Isaacks' radiocarbon site, fig. 128.) The black grama in this area appeared to have deteriorated more than that on the ridge crest at site 10b. In addition, the shrubs (soaptree yucca, cholla, and Mormon tea) were more numerous and larger than in 1967, when that photograph was taken.

Figure 18.—Photograph of the same area shown in figure 17 but taken in January 1991. The black grama shown in the 1920 photograph is no longer evident. In the early 1960s, wooden strands with copies of the 1920 photograph were placed along a tour route for visitors, so they could see the prominent change in vegetation since 1920 (personal communication, Carlton Herbel, 1991). These stands have fallen down with the passage of time. A remnant of one of the stands is in the foreground. The present vegetation consists of creosotebush, tarbush, bush muhly at the base of some shrubs, snakeweed, a few dropseed and soaptree yucca plants, and fluffgrass.

Figure 19.—Landscape of the late Jornada II surface and the Typic Calciargids (Yucca soils) at site 3 (fig. 4). Three pipes contain reddish brown Bt material. The Dona Ana Mountains are on the skyline. Photographed in October 1971.

Figure 20.—The same area photographed after a rainfall in July 2000. The location is several meters closer to the background vegetation.

Spread of Creosotebush and Other Shrubs

Figure 21 is an aerial view in and east of the New Mexico State University (NMSU) campus, showing repeat photography sites 1, 4, 5, and 7.

Two sites illustrate major increases in the size and numbers of creosotebush since 1960. These two are sampling sites of the National Soil Survey Laboratory—pedons 60-2 and 66-2 (figs. 22 to 25). In addition, a number of sites that were free of creosotebush in 1960 now support it as well as other shrubs, as is illustrated by the Typic Haplargid, Onite (figs. 26 and 27). Thus, in addition to increasing in size and number, the shrubs are rapidly expanding their total area. The three sites just discussed occur in the arid zone. Shrubs have also increased in size and number in the semiarid zone, where creosotebush is less common. This increase is illustrated by the Petrocalcid Hayner 60-5, discussed later.

The Typic Haplargid, Whitlock 60-2

Only creosotebush occurs at site 4 (figs. 22 and 23), which is on the Picacho surface, between Tortugas Dam and the State Police Office, on University Avenue. The trench exposes the soil at the sampling site of the Typic Haplocalcid 60-2; the area illustrates the substantial increase in the size of creosotebush in the 27-year period from 1962 to 1989.

The Typic Petrocalcid, Delnorte 66-2

Site 5 (figs. 24 and 25) occurs on the Jornada I surface east of Tortugas Mountain and south of Dripping Springs Road. The trench is the sampling site of the Typic Petrocalcid, Delnorte 66-2. In the 22-year period from 1966 to 1988, creosotebush, whitethorn, and ratany have increased considerably in size.

The Typic Haplargid, Onite

Site 6 (fig. 4) is the type locality of the Typic Haplargid, Onite (figs. 26 and 27) on the Organ surface south of U.S. Highway 70. The 28-year period from 1972 to 2000 shows the introduction of three new shrubs—creosotebush, mesquite, and snakeweed. In addition, the existing shrubs in 1972 (soaptree yucca and Mormon tea) have increased in size and number.

The Ustalfic Petrocalcid, Hayner 60-5

Shrubs have invaded soils of the semiarid zone along the mountain fronts as well as the arid zone downslope. This invasion is shown by photographs (taken in 1960 and 2000 (figs. 28 and 29) at site 7, on a ridge crest of the Dona Ana surface in Ice Canyon. In 1960, the vegetation was described as follows: snakeweed, spaced about 1 to 3 feet apart; grazed-off bunches of black grama and sideoats grama about a foot apart; scattered mesquite and cholla cactus. In May 2000, black grama and sideoats grama were still present, but the shrubs had greatly increased in number and size (fig. 29). See the section “Other Features of the Semiarid Zone” for a discussion of the soil.

Greater precipitation at this semiarid site (nearly double that at University Park, in the arid zone, according to climatic data in Gile and Grossman, 1979) is thought to be a major factor favoring the continued presence of black grama, despite the substantial encroachment of shrubs.

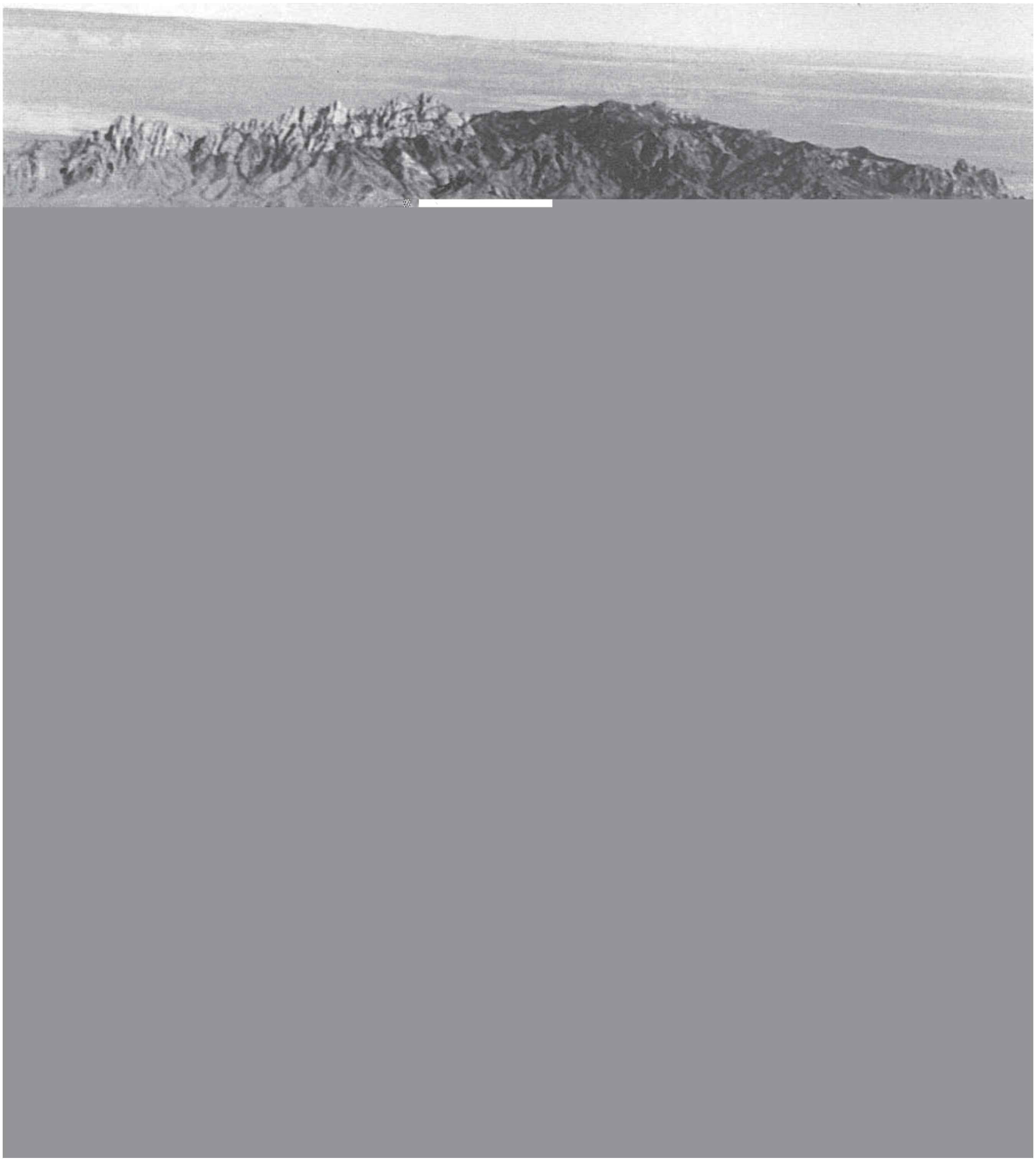

Figure 21.—A 1958 aerial view of repeat photography sites 1, 4, 5, and 7 (see figure 4). Sites 4 and 5 involve creosotebush, a common shrub in many places. The photographic record and observations indicate that creosotebush occurred first in dissected areas (see sites 4 and 5 above) and later spread to stabler undissected landscapes (e.g., see figure 27, discussed later). Site 4, at bottom above, is a dissected ridge of the late Pleistocene Picacho surface, now occupied mostly by NMSU. Site 4 is still preserved because it occurs in a protected area between Tortugas Dam and the State Police Office. Site 5 (at center right), directly east of Tortugas ("A") Mountain is also still preserved. The Sacramento Mountains are on the skyline; just this side are the Tularosa Basin and the Organ Mountains, respectively. Photographed in November 1958.

Figure 22.—Landscape and vegetation at site 4, the Typic Haplocalcid, Whitlock 60-2, in April 1962. The vegetation is creosotebush.

Figure 23.—Landscape and vegetation at Whitlock 60-2 in August 1989. Creosotebush is larger and more numerous than in 1962.

Figure 24.—Landscape and vegetation at site 5, the Typic Petrocalcid, Delnorte 66-2, in October 1966. The vegetation is creosotebush, ratany, and whitethorn. The Organ Mountains are in the background.

Figure 25.—Landscape and vegetation at Delnorte 66-2 in November 1988. Creosotebush, ratany, and whitethorn are larger and more numerous than in 1966 (fig. 24).

Figure 26.—Landscape and vegetation at site 6, the Typic Haplargid, Onite, in March 1972. The foreground vegetation consists of six-weeks grama and several small Mormon tea plants; soaptree yucca also occurs in the background. The view is north.

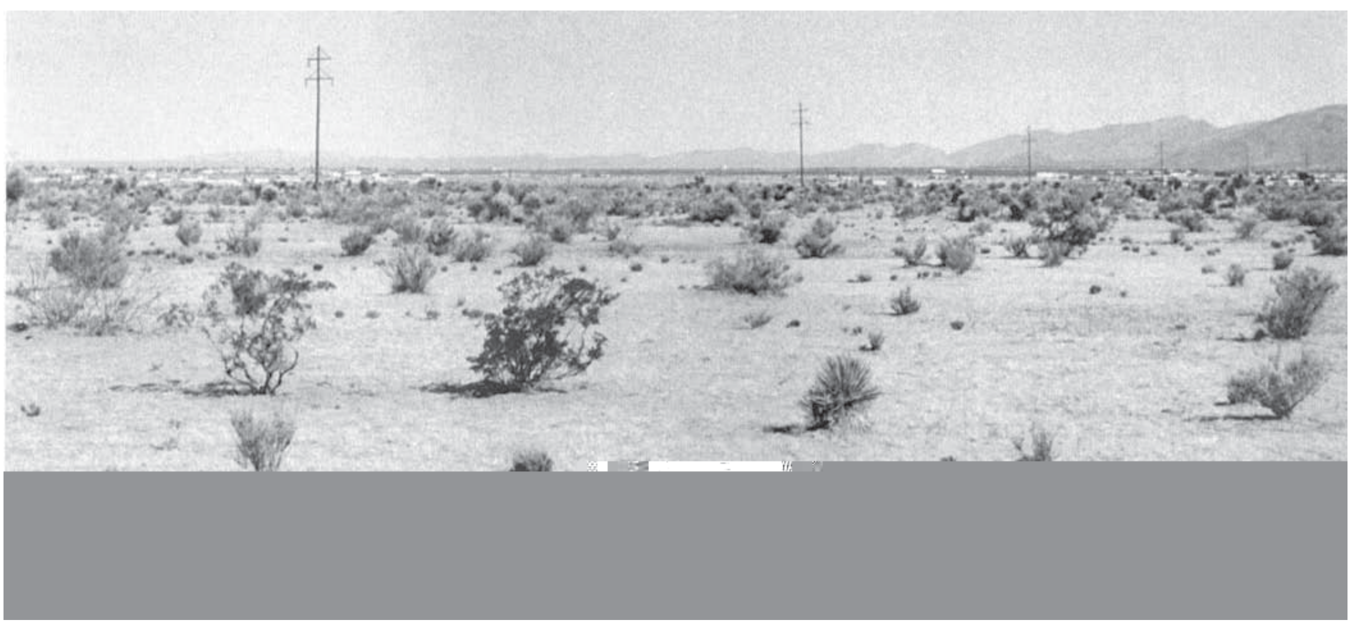

Figure 27.—Landscape and vegetation at site 6, March 2000. Four new shrubs are now in the foreground and middle ground. Mesquite occurs at the far left in the middle ground; just this side and to the right of the mesquite are two creosotebushes. A small soaptree yucca occurs to the right of the second creosotebush. A small snakeweed occurs just this side of the second creosotebush.

Figure 28.—View of site 7 and the Dona Ana surface and ridge crest in Ice Canyon. The ridge crest is bedrock-defended and protected from erosion in part at left and right. Snakeweed was the dominant shrub in 1960. Photographed in April 1960.

Figure 29.—Although black grama and sideoats grama were still present in 2000, the shrubs, mostly mesquite, whitethorn, and cholla cactus, have greatly expanded. In the foreground, Curtis Monger is cleaning out the study trench in preparation for a field study tour in May 2000. A large whitethorn shrub growing on the east end of the trench was cut down in preparation for the tour. The trench exposes the Ustalfic Petrocalcid, Hayner 60-5, and is the type locality for the series. Photographed in May 2000.

A Color Presentation of Selected Features in the Desert Project

In this section color photography, maps, and diagrams illustrate some of the Desert Project features: the effects of increasing precipitation from the arid to the semiarid zone; other features of the semiarid zone; the effects of moisture differences caused by surface and subsurface concentrations of moisture; sites dated by radiocarbon ages of buried charcoal; soils of Holocene scarps in high-carbonate materials; morphological features; the effects of human activities on eolian erosion and sedimentation; and the reconstruction of ancient soils and landscapes. Thin sections illustrate major micromorphological features, particularly the accumulation of carbonate and silicate clay. The color photographs and photomicrographs illustrate highly significant age-related changes in soils that range in age from late Holocene to late Pliocene, a timespan of about 2 to 2½ million years (table 2). No color photography is available for a few soils; for these, black and white photographs are used because they are the only photographic record available. Scales are in feet unless otherwise indicated. Figure 30 locates the sites.

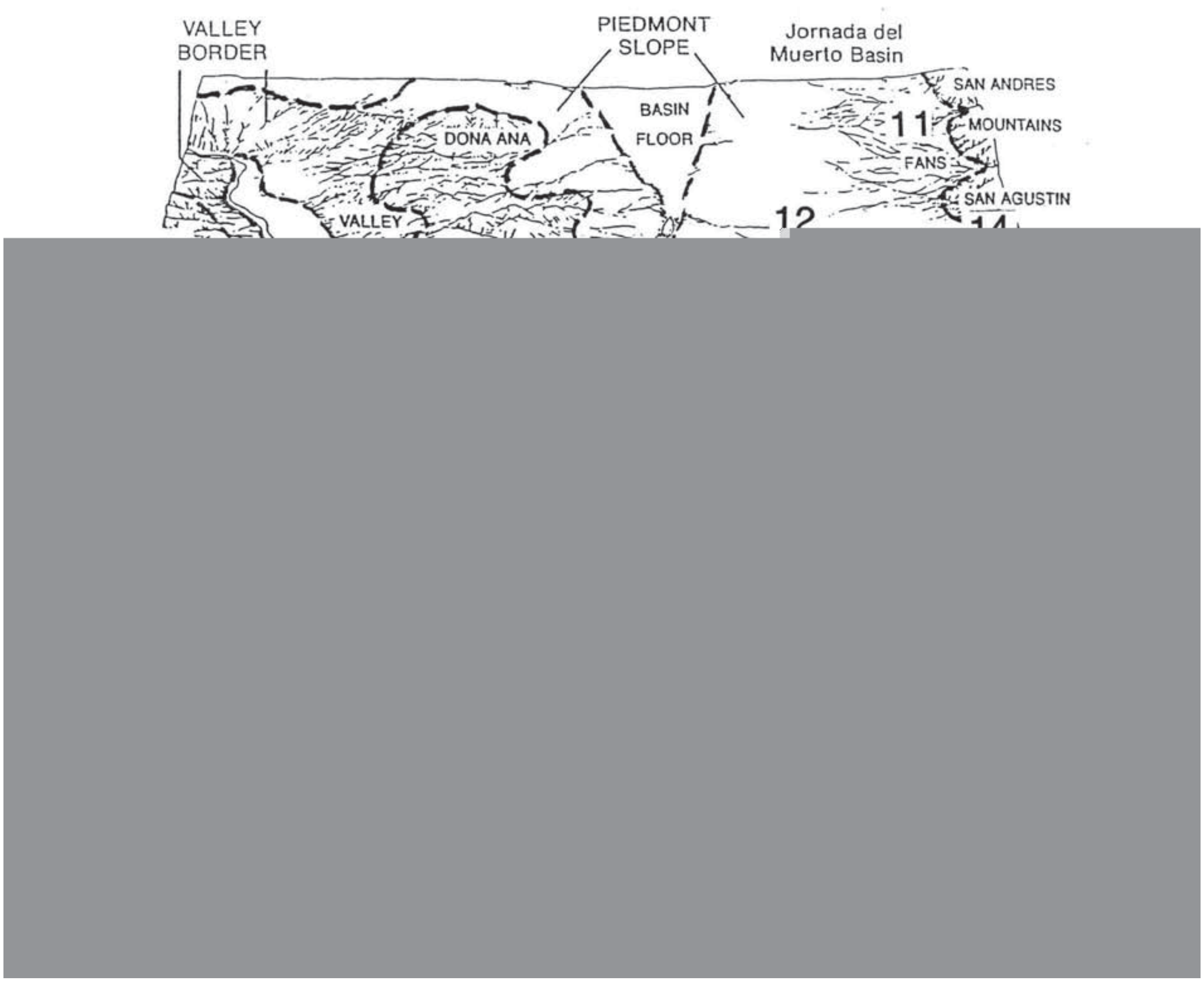

Figure 30.—Location of sites illustrated primarily by color photography: 1) depth to the top of a carbonate accumulation in the arid zone; 2) depth to the top of a carbonate accumulation in the transition from the arid to the semiarid zone; 3) depth to the top of a carbonate accumulation in the semiarid zone; 4) the effect of surface moisture concentration in the arid zone and pipes of the lower La Mesa; 5) the effect of surface moisture concentration in narrow and broad drainageways in the arid zone; 6 and 7) the effect of subsurface moisture concentration in pipes in the arid zone; 8) the Shalam Colony radiocarbon site; 9) the Fillmore Arroyo radiocarbon site; 10) the Isaacks' radiocarbon site; 11) the Gardner Spring radiocarbon site; 12) the soils of Holocene scarps; 13) the Ice Canyon site; and 14) four sites in the vicinity of Organ.

Effects of Increasing Precipitation From the Arid to the Semiarid Zone

In low-carbonate parent materials, increasing precipitation mountainward increases the thickness of Bt horizons and the depth to a zone of carbonate accumulation. The relationships have been summarized as follows (from Gile, 1977, pp. 115, 116):

> In low-carbonate parent materials the arid-semiarid transition is characterized by differences in thickness of a surficial noncalcareous zone, by morphological differences in the soils, and in many places by differences in soil-geomorphic relations.
>
> Relations between precipitation and thickness of the noncalcareous zone are best shown by Holocene soils. This is because infiltration and depth of moisture penetration in these soils are not confounded by prominent horizons that developed in the Pleistocene.
>
> Differences in thickness of the noncalcareous zone were noted at various places that constitute a transect from the arid into the semiarid zone. The observations were made at sites with the following characteristics. Infiltration rates are rapid since texture is sandy loam and the materials are very gravelly. All sites are on stable landscapes that are level or nearly level transversely. These factors should minimize runoff and maximize infiltration. The sites are on slight ridges or terraces so that there would be little or no run-in from areas upslope.
>
> Thickness of the noncalcareous zone gradually increases mountainward, reflecting the increase in precipitation. As this happens, the horizon of silicate clay accumulation also thickens and the top of the carbonate horizon deepens. These relations add supporting evidence for an illuvial origin of some of the clay as well as the carbonate. In Holocene soils the horizon of silicate clay accumulation is just above or extends slightly into the carbonate horizon. This arrangement would be expected on a theoretical basis if the horizons were illuvial. That is, the clay would move downward in suspension (Thorp et al., 1957, 1959) and accumulate in a zone that is wetted frequently during the rainy season. Bicarbonate, being in solution rather than suspension, would be expected to move deeper than the clay and then to precipitate below it as the soil solution dries. The fact that this horizon arrangement persists with increasing precipitation is additional evidence that illuviation is a major factor in the development of both silicate clay and carbonate horizons.
>
> In places the accumulations of carbonate and clay diverge at the highest elevations, where some Bt horizons are not underlain by a carbonate horizon. This is generally the case in sandy loam and sandy textures; apparently the carbonates were moved to substantial depths by occasional very deep wettings. However, stage I carbonate horizons, typical of Holocene soils in the arid basin downslope, have been observed in textures of sandy clay loam. This suggests that the finer textures may tend to slow the downward movement of the soil solution and thereby cause the horizon of carbonate accumulation.

Thickness of the noncalcareous zone and depth to the top of the carbonate horizon with increasing precipitation are illustrated by three soils of late Holocene age at sites 1 to 3, a transect from the arid to the semiarid zone (figs. 30 to 36). All three soils are of late Holocene age and have formed in the same kind of parent materials, rhyolite alluvium from the Organ Mountains. As elevation increases from 4,350 to 5,700 feet, the only factor that changes is the precipitation. These relations show that increasing precipitation moves carbonate deeper into the soil.

In older soils the relation between carbonate accumulation and precipitation is more complicated but still evident. For example, gravelly soils of Jornada I age in the arid zone have prominent stage IV horizons but only stage I horizons in the semiarid zone.

Effects of Surface Moisture Concentration in the Arid Zone

Thickness of the noncalcareous zone can also differ considerably in soils at the same general elevation. The major factor responsible for this difference is the concentration of moisture by landscape position. This is illustrated by soils in small depressions and narrow drainageways. On a larger scale, the effects of surface moisture concentration in broad drainageways and on basin floors are illustrated in later sections.

Figure 31.—Landscape at site 1 on the Fillmore surface in the arid part of the Desert Project. Elevation is 4,350 feet, and precipitation is about 20 cm per year.

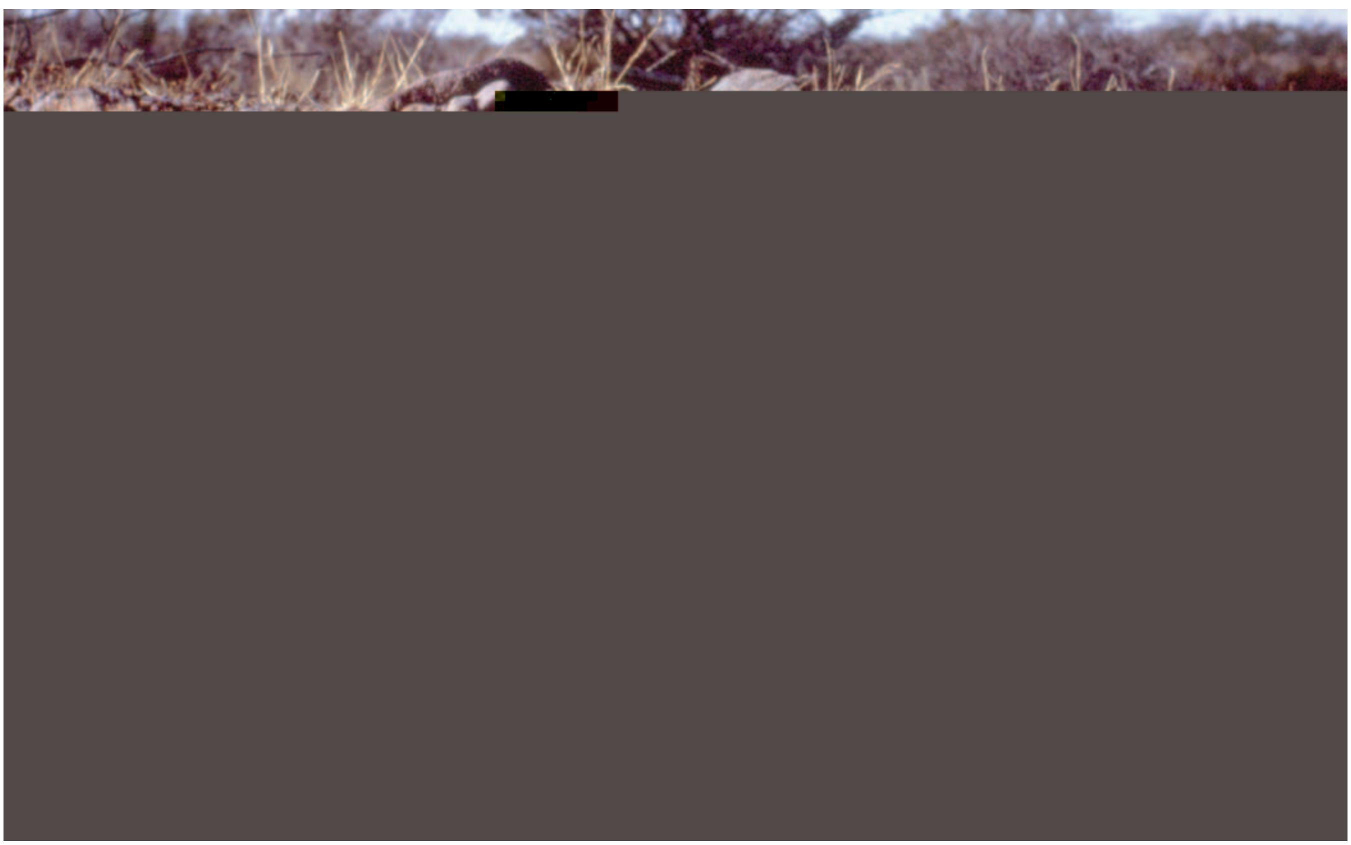

Figure 32.—Soledad 66-16, a Typic Haplargid. The top of the stage I carbonate horizon is at a depth of 25 cm just above the 1-foot marker on the tape.

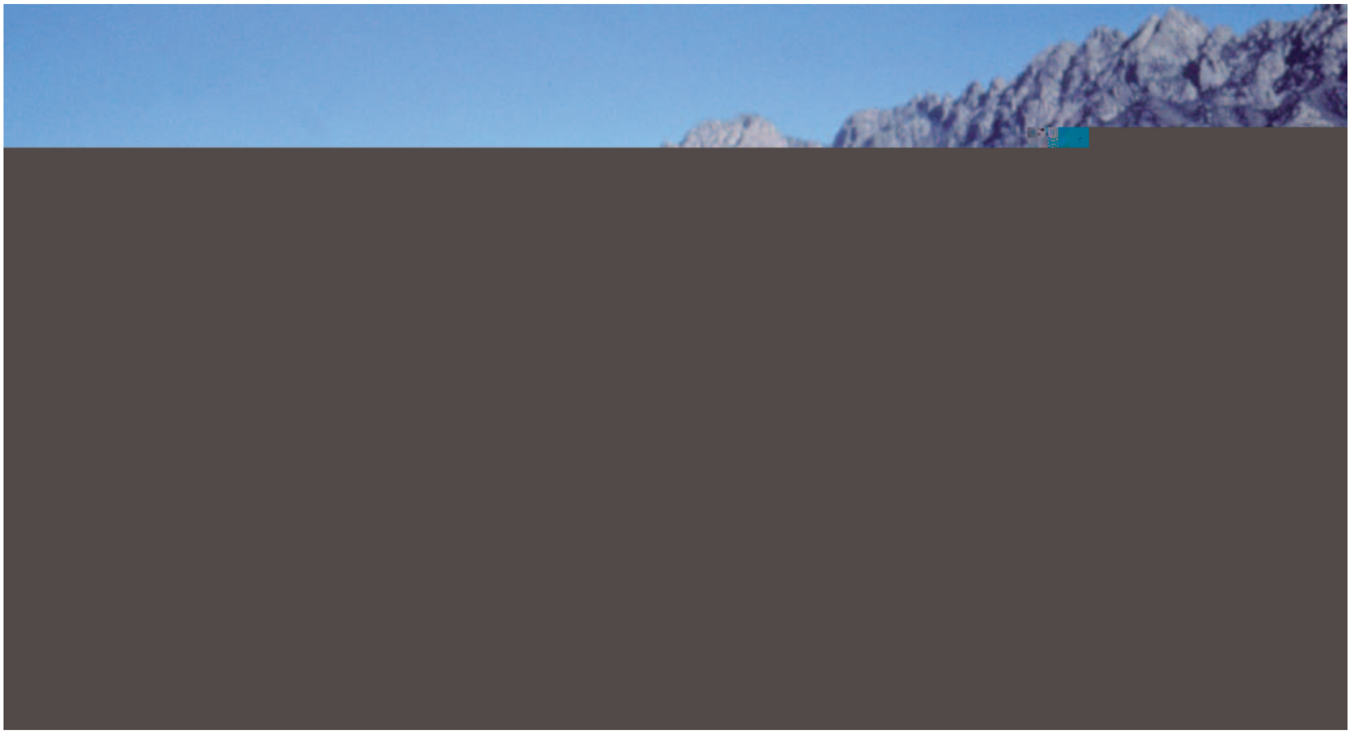

Figure 33.—Landscape at site 2 on the Organ surface and closer to the mountains than site 1. Elevation is 4,730 feet. This soil receives a few centimeters more precipitation per year than the soil at site 1.

Figure 34.—The upper horizons of Soledad 67-4, a Typic Haplargid. Because of greater moisture, the top of the stage I carbonate horizon is at a depth of 51 cm, compared to 25 cm at site 1.

Figure 35.—Landscape at site 3 on the Organ surface in Soledad Canyon of the Organ Mountains. Elevation is 5,700 feet, and precipitation is nearly 40 cm per year.

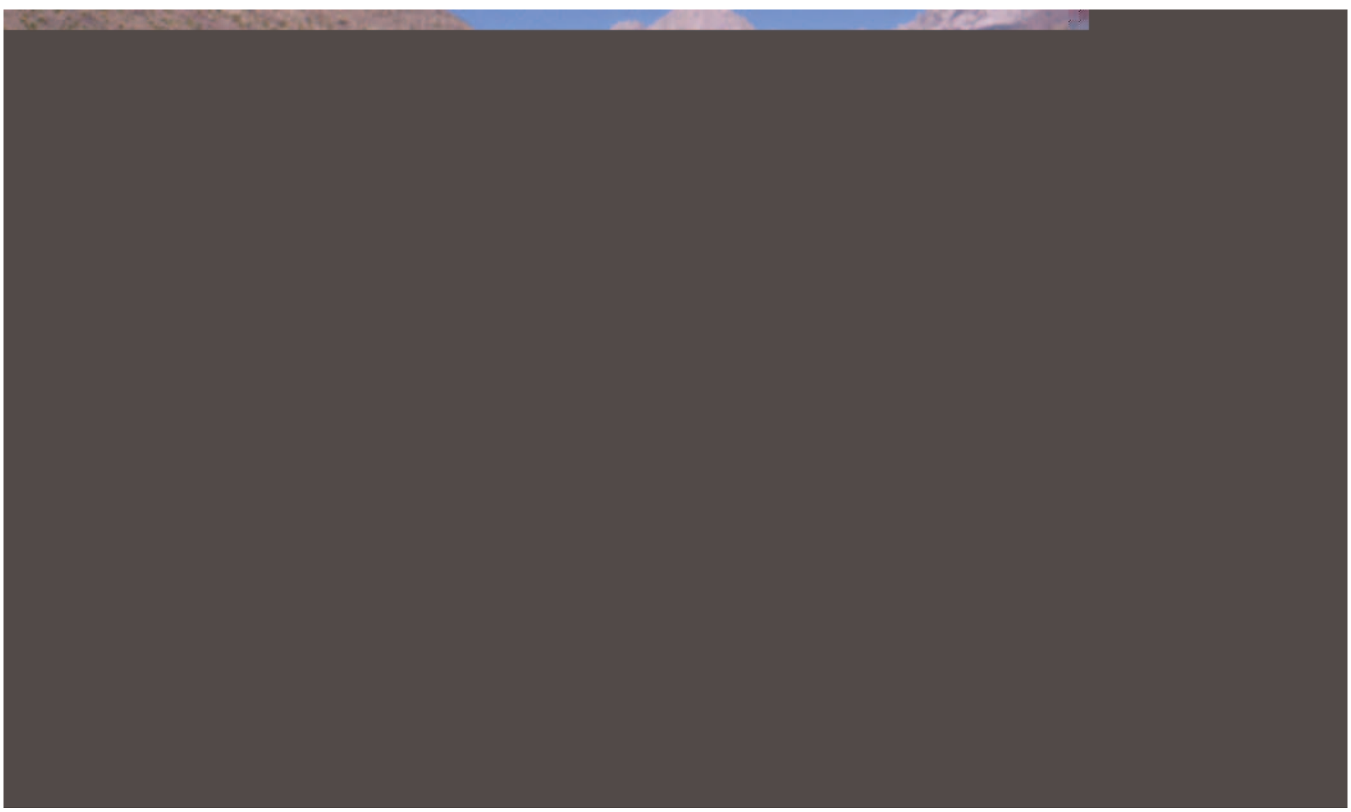

Figure 36.—Santo Tomas 60-12, a Pachic Haplustoll. Because of greater precipitation, the top of the carbonate horizon is still deeper, below 104 cm.

Small Depressions

Figures 30 and 37 locate two illustrative soils on the lower La Mesa, of early middle Pleistocene age (table 2). The two soils have formed in sediments deposited by the ancestral Rio Grande. One soil occurs in a small depression (no. 1, fig. 37); the other occurs outside the depression (no. 2, fig. 37).

The soil outside the depression is the Typic Petroargid, Rotura (figs. 38 and 39), and is calcareous throughout. The Rotura soils of the lower La Mesa illustrate the transition between stages III and IV of carbonate accumulation in these low-gravel materials. The plugged K21m horizon of Rotura soils also illustrates dissolution features of silicate grains by pressure solution, as shown by nearby study area 26 (Gile et al., 1995b; fig. 40; see also Monger and Daugherty, 1991, for further discussion of pressure solution). In addition, Si occurs as bridges between some grains in the C horizon (fig. 41); this Si could have been derived from the dissolution process noted above. Dissolution of silicate grains by pressure solution is also shown by soils of the upper La Mesa (fig. 42) and Jornada I (fig. 43) age. Apparently, as calcite continues to accumulate, the process of calcite crystallization exerts pressure on silicate grains, causing dissolution features, such as serrated margins of the grains. The process is most common in plugged horizons because there is less pore space; the silicate grains are more tightly held and thus more susceptible to the dissolution process.

The Typic Calciargid, Berino 68-2 (figs. 44 and 45), illustrates the soil in the depression. It has a calcic instead of a petrocalcic horizon. Except for the upper 5 cm, this soil is noncalcareous to a depth of 33 cm, in contrast to the Petroargid outside the depression. The difference is attributed to the stable landscape position and to more run-in from adjacent areas, which helps to move carbonates to a depth greater than the depth to carbonates outside the depression. A surficial calcareous zone underlain by a noncalcareous zone, as at this site, is common in topographic lows of the study area and is attributed to carbonate additions from run-in water and from dustfall. Carbonate is accumulating at the soil surface faster than it can move into the soil under the present climate.

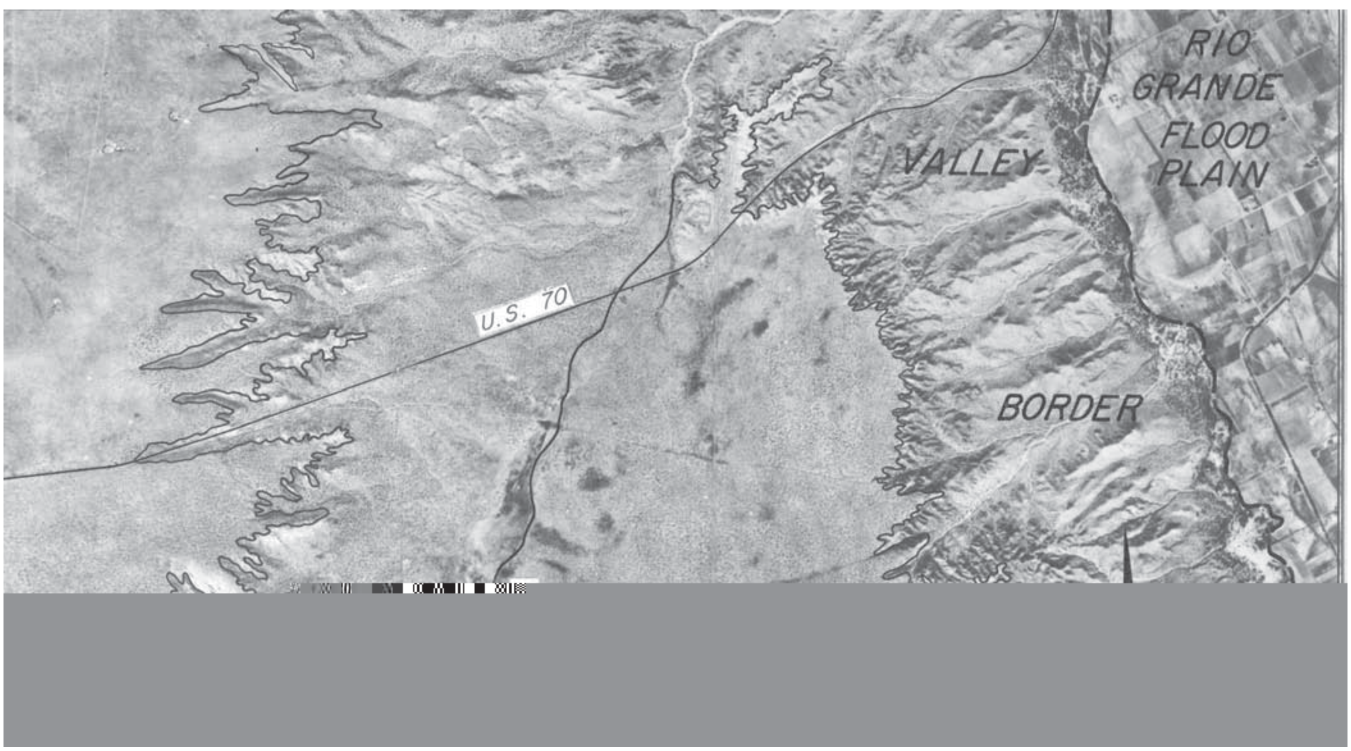

Figure 37.—A 1936 aerial photograph that locates two illustrative soils on the lower La Mesa. The depressions are elongated to roughly circular, dark areas, primarily on the left (western) side of the lower La Mesa. No. 1, left, locates a studied soil in a small depression. No. 2, right, locates a soil away from the depression. The two soils have formed in sandy sediments deposited by the ancestral Rio Grande. In the vicinity of U.S. Highway 70, Organ sediments (which do not grade to the valley border) grade to a complex of Fillmore sediments (which do grade to the valley border) and beveled La Mesa sediments.

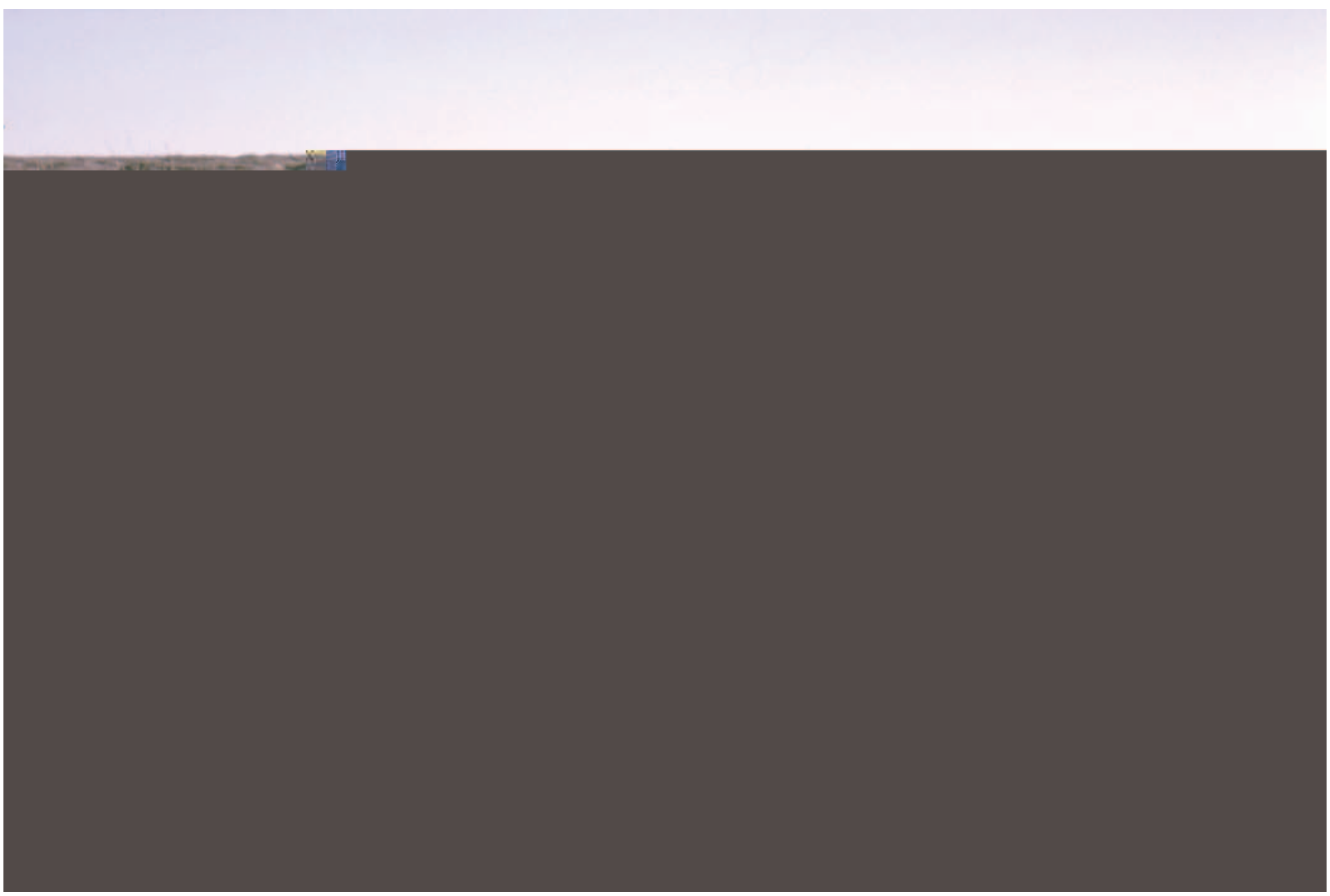

Figure 38.—Landscape away from the depression in the lower La Mesa. Typic Torripsamments (Bluepoint soils) are on the dunes. Typic Petroargids (Rotura soils) are between the dunes.

Figure 39.—The argillic horizon and the top of the petrocalcic horizon in the Rotura soil. The soil is calcareous throughout. However, not enough carbonate has accumulated to obliterate the argillic horizon; volumes of Bt material are still preserved. The petrocalcic horizon illustrates late stage III (plugged) carbonate; a laminar horizon has not yet formed. The lower La Mesa illustrates initial development of stage IV in low-gravel materials.

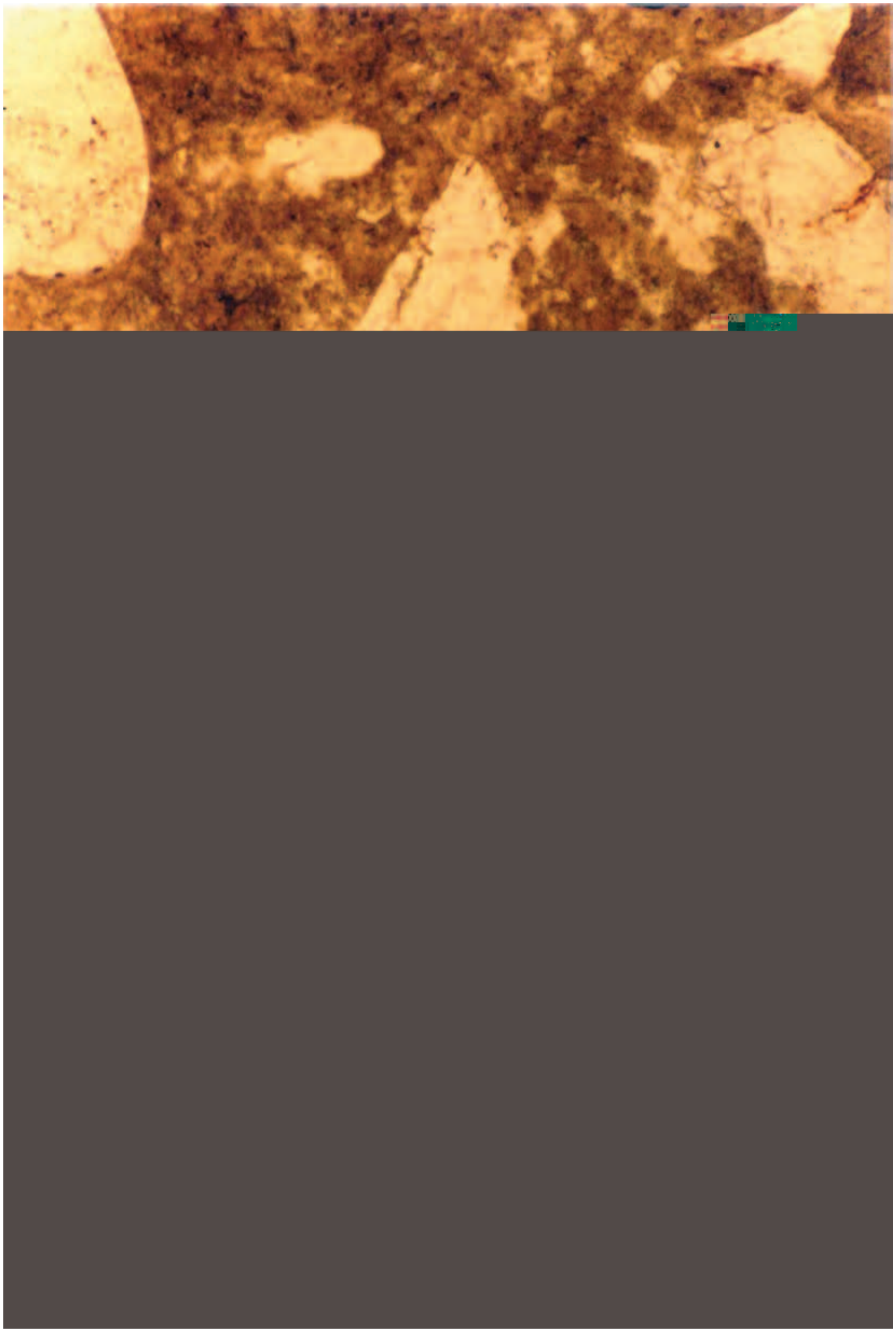

Figure 40.—Thin section of the plugged part of the K21m horizon in the Typic Petroargid, Rotura. The primary grain in the center has been partly dissolved and replaced with calcite. Grains are dominantly quartz and are separated by the micrite matrix. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 10 μm.

Figure 41.—Thin section of the C1 horizon in the Typic Petroargid, Rotura. Arrows locate opal miniscus bridges between grains, which are mostly quartz and rhyolite. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

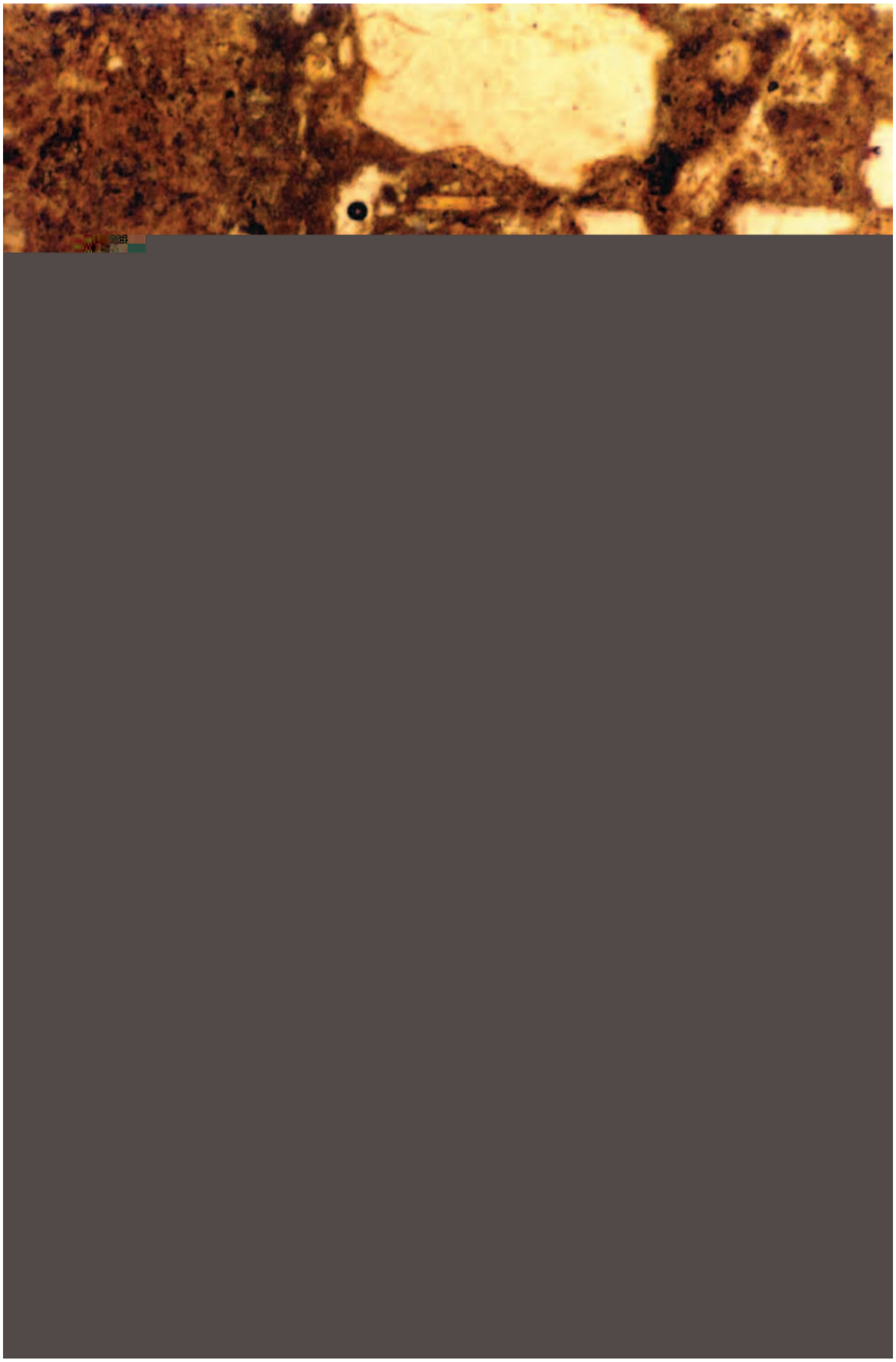

Figure 42.—Thin section of the K21m horizon in the Argic Petrocalcid, Cruces. Grains are dominantly feldspar, with some quartz. The matrix material is micrite. The plagioclase in the center has been partly dissolved and replaced by micrite. *Upper*, plane-polarized light; *lower*, crossed polarizers. Bar scale = 100 µm.

Figure 43.—Thin section of the K2 horizon in the Typic Haplocalcid, Algerita. Voids (arrows) are around some grains; others have been replaced by carbonate (e.g., at left of the arrow in the bottom photomicrograph). The matrix material is micrite (K-fabric). Plane-polarized light. Bar scale = 100 µm.

Figure 44.—Landscape view of part of the depression in the lower La Mesa. Typic Calciargids (Berino soils) are dominant in the depression. Mesquite shrubs are more numerous in the depression than outside it. The shrubs are largely responsible for the darker colored depression in the aerial photograph. The prominent coppice dunes do not occur in the depressions because thicker vegetation, greater moisture, and finer textures of the upper horizons help to resist erosion. The view is east. On the skyline are the Organ Mountains at right and the San Agustin Mountains at left. Photographed in February 1969.

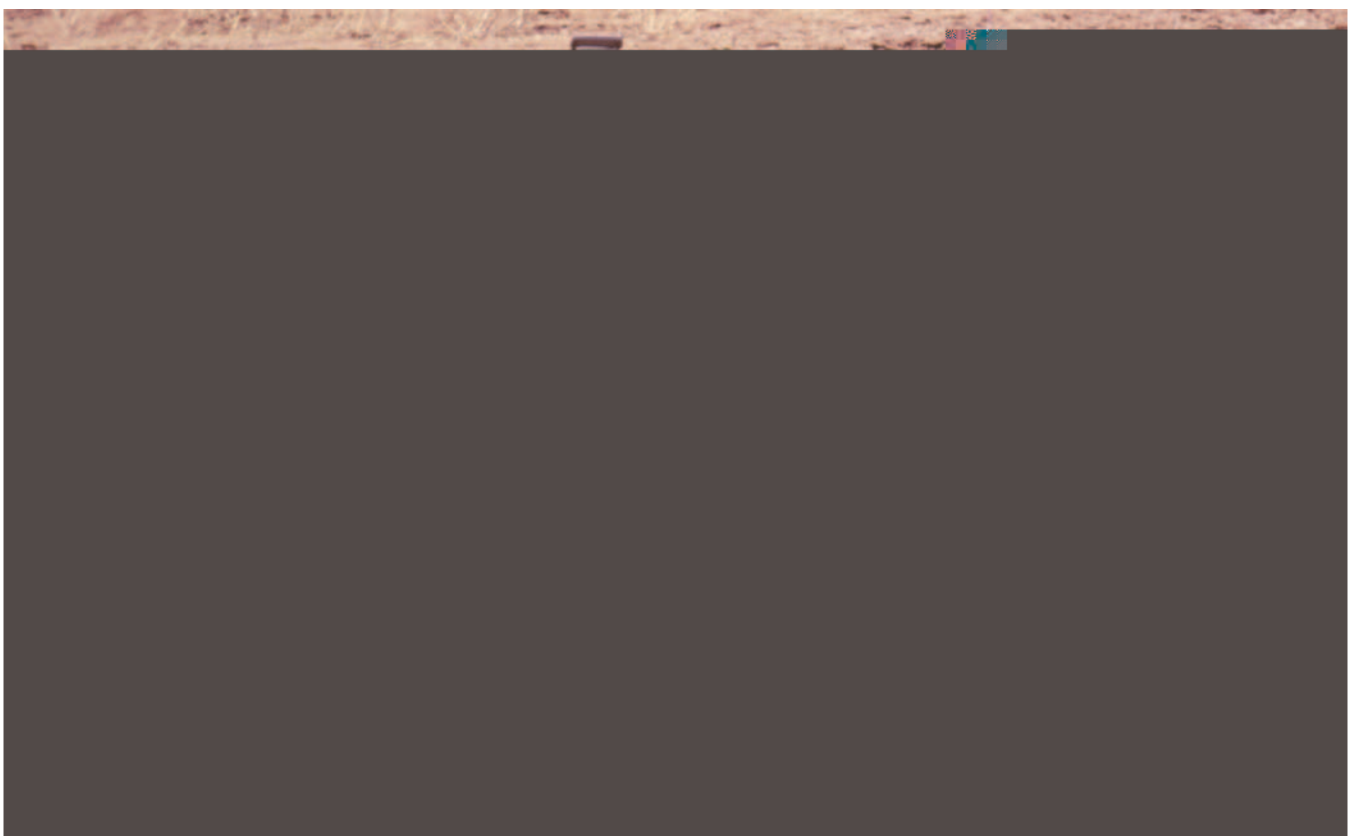

Figure 45.—The upper horizons of the Typic Calciargid, Berino 68-2. In contrast to the Rotura soil, which is calcareous throughout, this soil is noncalcareous to a depth of 33 cm, except for the upper 5 cm.

Narrow Drainageways

Figures 46 to 48 show U.S. Highway 70 and adjacent areas west of the valley. The roughly east-west lines that parallel Highway 70 (figs. 47 and 48) are gullies that formed along the old roads. The roads intercept runoff water, funneling it down the roads and forming long gullies. These gullies have been very useful in the study of the morphology of the soils and in determination of the stratigraphy of the fan piedmont. Since the gullies cross drainageways of various sizes, they are also useful in the study of the effect of drainageway size and position on soils and sediments of different ages.

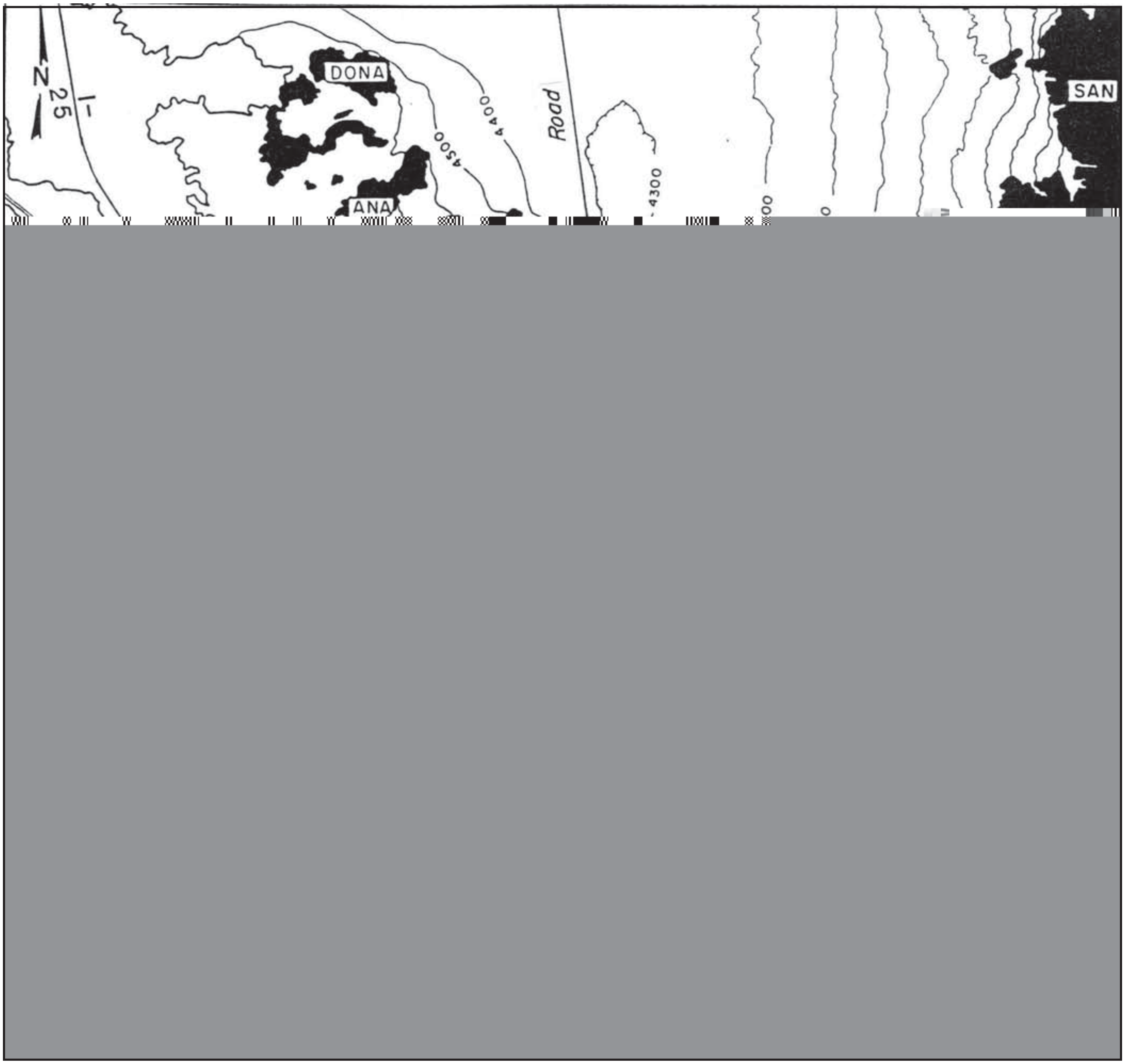

Figure 46.—Major physiographic features and highways in the Desert Project area. Isaacks Lake playa and the floor of the Jornada Basin are north of Highway 70, upper right.

Figure 49 locates a narrow drainageway in the Jornada II surface; figure 50 is a soil map that locates two illustrative soils, one in and one adjacent to a narrow drainageway. The Typic Calciargid, Berino 60-7 (figs. 51 and 52), exemplifies the soils adjacent to the drainageway. Thin sections (fig. 53) show no argillans on ped faces, but prominent grain argillans occur on sand grains, as is typical of argillic horizons in this area.

The Typic Haplargid, Bucklebar 66-8 (figs. 54 and 55), exemplifies the soils in the narrow drainageway. The Jornada II sediments could be continuously traced between Bucklebar 66-8 and Berino 60-7. The sediments in the drainageway are the same late Pleistocene age as those adjacent to the drainageway, except for young stratified sediments from 0 to 8 cm and Holocene sediments from 8 to 51 cm.

Figure 47.—An aerial view along Highway 70 at left center, east towards San Agustin Pass at the upper center. The San Agustin Mountains are to the left of the pass, and the Organ Mountains are to the right of it. The Tularosa Basin can be seen beyond the Organ Mountains. Photographed in November 1958.

Figure 48.—A 1936 aerial photograph that shows U.S. Highway 70 and the Jornada Road. The rectangle locates a contour map and two soil maps (see figure 49).

Figure 49.—An aerial photograph (see figures 46 and 47) that shows U.S. Highway 70, contour lines, a narrow drainageway, and a broad one. The two rectangles locate soil maps to be seen later. Contour lines are in feet.

Figure 50.—A soil map that locates two soils, one in and one near the narrow drainageway shown in figure 57. A gully crosses the drainageway and exposes illustrative soils near the drainageway (no. 1) and in the drainageway (no. 2). Spots in the spotted pattern are mesquite-covered coppice dunes. Unit A is dominated by Haplargids of the Bucklebar series. Most of unit B has been cleared of dunes, and the soils are Calciargids, primarily of the Berino series.

Figure 51.—Landscape adjacent to the narrow drainageway in the Jornada II surface (fig. 50). Typic Torripsamments (Bluepoint soils) are on the dunes. Typic Calciargids (Berino soils, fig. 52) are between the dunes.

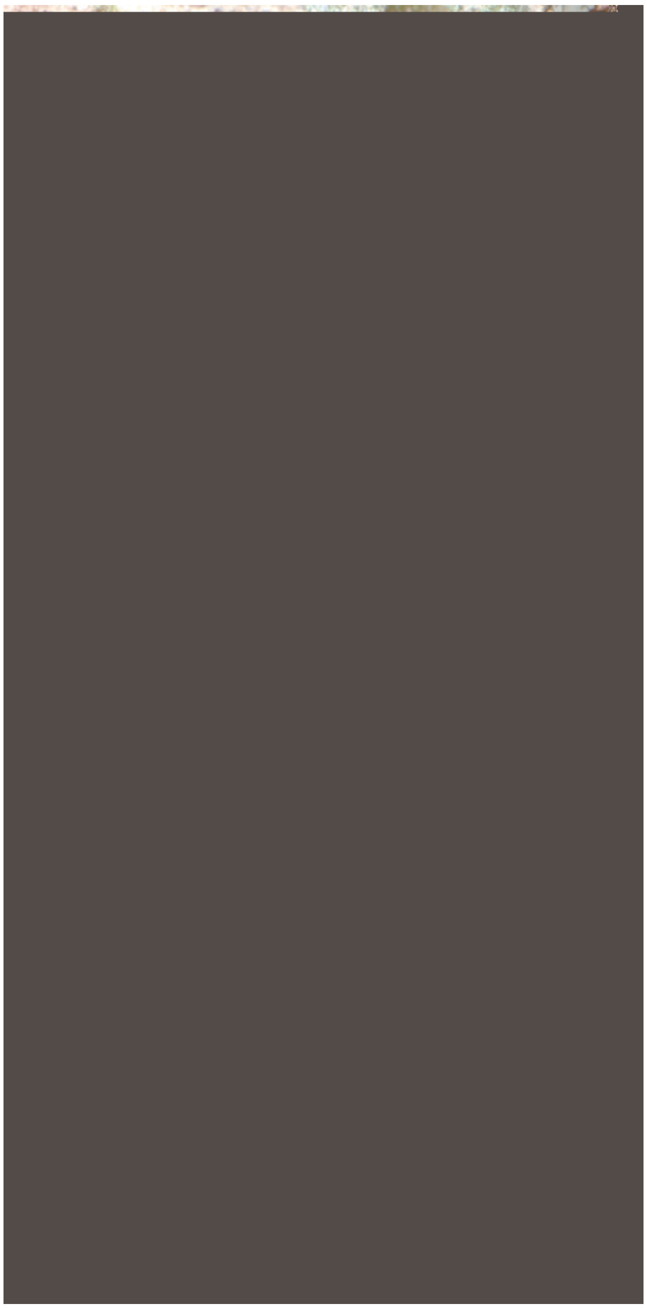

Figure 52.—The Typic Calciargid, Berino 60-7, which illustrates the typical thickness of the noncalcareous zone adjacent to the drainageway. Except for a very few carbonate filaments, this soil is noncalcareous to a depth of 33 cm. The scale is in feet. Photographed in June 1968.

Figure 53.—Thin section showing prism faces in the Bt horizon of the Typic Calciargid, Berino 60-7. Argillans are common on sand grains, which are dominantly quartz, but do not occur on prism faces. Crossed polarizers. Bar scale = 0.5 mm.

Figure 54.—Landscape of the narrow drainageway in the Jornada II surface. Typic Haplargids (Bucklebar soils) are dominant.

Figure 55.—The Typic Haplargid, Bucklebar 66-8, which is texturally similar to the Berino soil but does not have a calcic horizon within a depth of 1 m. Except for the upper 8 cm, which is calcareous, this soil is noncalcareous to a depth of 124 cm, more than three times as deep as in the Calciargid outside the drainageway. The scale is in meters.

Features of Broad Drainageways: Buried Soils, Natural Gullies, Gully Fills, and Inherited Drainageways

In contrast to soils in narrow drainageways, which have commonly formed in deposits of one or two ages, soils in broad drainageways may contain fairly large deposits of multiple ages and associated stratigraphic and pedogenic phenomena (figs. 56 and 57). Thin sections of pipes show prominent argillans in pores and on faces of peds (fig. 58).

Arrows across the gully (fig. 56) locate prehistoric gully fills that are exposed in the present gully. These gully fills are of Isaacks' Ranch age, or about 10,000 to 15,000 years old. The gully fills are well exposed on both sides of the present gully and were also observed

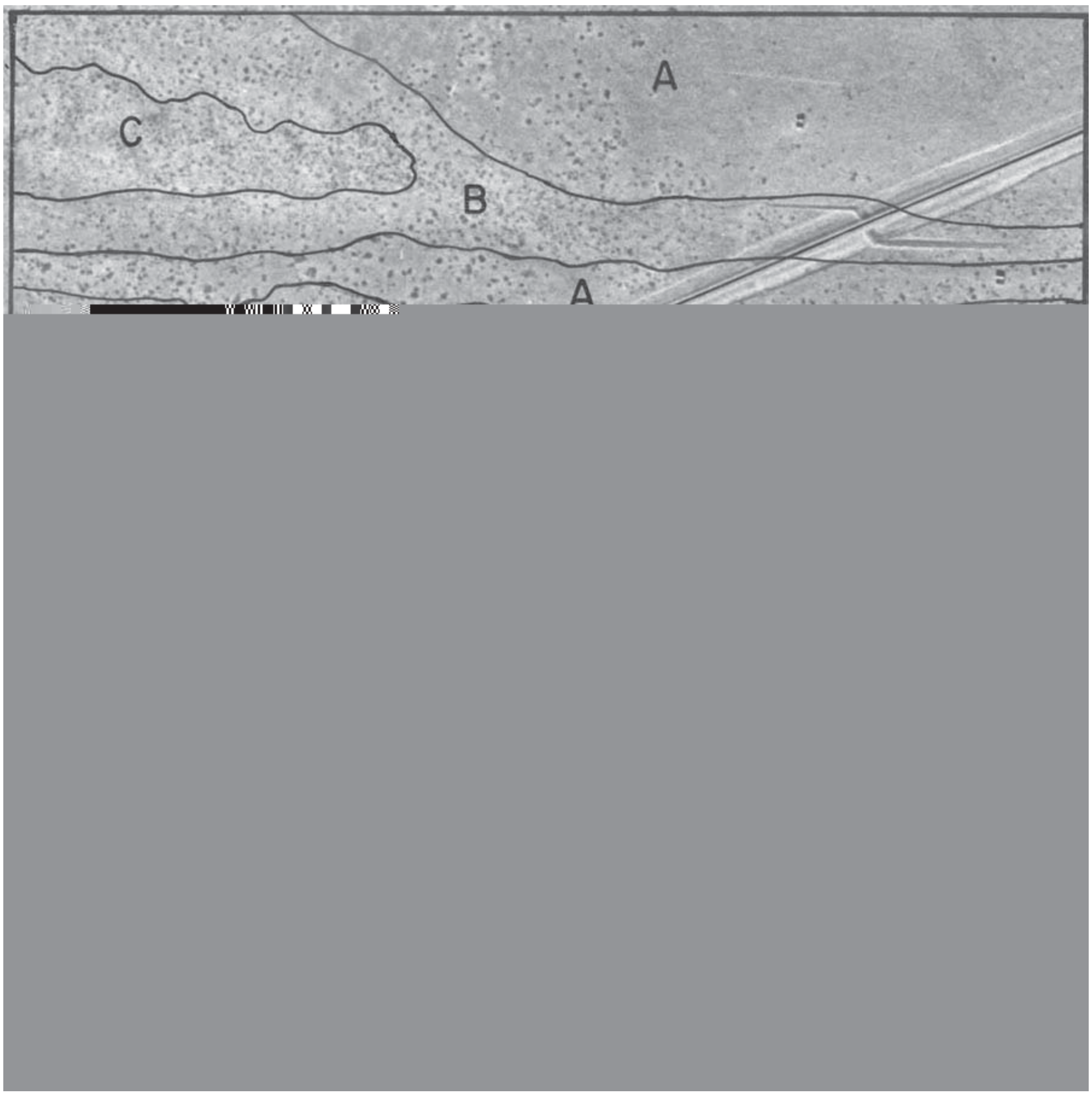

Figure 56.—Soil map of part of the broad drainageway that crosses U.S. Highway 70 (see figure 49). The upper diagonal road is Highway 70. The lower road is an older dirt road, and a deep gully has formed along its south edge. The gully exposes the soils and sediments in the drainageway. The soil pattern is more complex than is suggested by the generally smooth relief. Map unit A is dominated by Calciargids of the Yucca series, and map units B and C are dominated by Calciargids of the Berino series. Soils of unit B differ from those of unit C in having a weaker Bt horizon and a stage II carbonate horizon instead of stage III. No. 1 locates an exposure to three different ages, where the upper sediment and its soil are thin. No. 2 locates an exposure of the same ages, where the upper sediment thickens in a gully fill. The arrows locate and show the trend of Isaacks' Ranch gully fills that cross the present gully (see figures 59 to 61).

in a gas line trench north of Highway 70. Thus, the gullies were an important part of the ancestral drainage system in the area.

Because the deposits are thin, no C horizon material occurs between the three sets of genetic horizons shown in figure 57. Such C horizons do occur elsewhere along the gully, as illustrated by the Typic Haplargid, Bucklebar 88-1 (figs. 59 to 61). These C horizons are conclusive evidence that the horizons in Jornada I and II alluvium represent buried soils, formed when each alluvium was at the land surface.

Pedon 88-1 has the nodular stage II carbonate that is typical of Isaacks' Ranch age. Thin sections (fig. 62) show the characteristic grain argillans on sand grains. Some argillans have been obliterated by carbonate (fig. 63).

Figure 57.—A 1965 photograph showing the general stratigraphy that typifies much of the broad drainageway: a) Jornada I alluvium and a buried Calciargid with stage III carbonate; b) Jornada II alluvium and a buried Calciargid with stage III carbonate; c) Isaacks' Ranch alluvium and a land-surface Haplargid with stage II carbonate. Pipes are outlined at left and right of the tape; the thin section (fig. 58) is from the pipe at right. These pipes, with their downward extension of the argillic horizon, must have formed before the end of the last Pleistocene full-glacial, 17,000 years ago, because they are buried by Isaacks' Ranch alluvium. This is No. 1 in figure 56.

Figure 58.—A thin section from the pipe noted in figure 57. Pipes like this contain the only argillans on ped surfaces and in pores in the arid part of the Desert Project, where most argillic horizons have prominent coatings of oriented clay on sand grains instead of argillans like this. The pore in the center is about 0.15 mm in diameter.

Figure 59.—Isaacks' Ranch gull fill and the underlying alluvial materials: a) Jornada I alluvium and soils; b) Jornada II alluvium and soils; c) Isaacks' Ranch alluvium and soils. The topographic low in both Jornada I and II alluvial sediments beneath the Isaacks' Ranch gully fill shows that drainageways of all three ages occurred in about the same position. This is clear evidence that some channel positions are inherited and remain about the same throughout major periods of sedimentation and soil formation. What causes these natural gullies to form and later to fill with sediments? According to Antevs (1955), rainfall is effectively absorbed during moist times when the plant cover is ample and healthy. Prolonged dry ages, however, greatly reduce the plant cover, increasing runoff and forming gullies or arroyos in the streambeds. When moisture conditions are transitional between very dry and moist times, the vegetation is still sparse on uplands but is more common in gullies or arroyos. During these times, sediment eroded from the uplands is deposited among the growth in the channels below. Eventually, the channels backfill with sediment, forming the gully fill exposed by the present human-caused gully. Photographed in March 1965.

Figure 60.—The Typic Haplargid, Bucklebar 88-1, in the same Isaacks' Ranch gully fill shown in figure 59 but photographed in November 1981. Such gully fills, emplaced in much older sediments and soils, cause abrupt soil changes not suggested by the smooth relief and uniform slope that crosses the soil boundaries. This is No. 2 in figure 56.

Figure 61.—The Typic Haplargid, Bucklebar 88-1, with the nodular stage II carbonate that is typical of Isaacks' Ranch age. In contrast to the soil of the same age shown in figure 57, here the Bt horizon is underlain by thick C horizon material. This is conclusive evidence that the horizons above the Jornada II Bt horizon in figure 57 formed in a deposit younger than Jornada II.

Figure 62.—Thin section of the Bt horizon in the Typic Haplargid, Bucklebar 88-1. Grain argillans are common. Grains are dominantly quartz, with some feldspar, rhyolite, and biotite. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

Figure 63.—Thin section of the Btk horizon of the Typic Haplargid, Bucklebar 88-1. The arrow locates an obliterated argillan on a rhyolite grain (r). Although a reddish coating is still evident on the grain, enough carbonate has accumulated in the coating to obliterate the orientation. Other grains are quartz and feldspar. Argillans are still preserved in parts of the Btk horizon. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

The Basin Floor North of Highway 70

The basin floor north of Highway 70 illustrates major contributions of moisture from two mountain ranges and the slopes below them: the Dona Ana Mountains on the west and the San Andres-San Agustin mountain chain on the east (fig. 46). Three major soils on this basin floor are the Ustic Calciargids, Stellar soils, the Ustic Haplocalcids, Reagan soils, and the Chromic Haplotorrerts, Dalby taxadjunct (figs. 64 to 72). The Stellar soils are on the Jornada I surface and have formed in alluvium derived from mixed igneous rocks from the Dona Ana Mountains. The Reagan soils are on the Petts Tank surface and have formed in high-carbonate alluvium from the San Andres Mountains. The Dalby taxadjunct is on the Lake Tank surface and has formed in playa sediments of mixed origin, including rhyolite, monzonite, andesite, limestone, and sandstone.

Except for the playa, the Stellar soils occupy the lowest part of the basin and have a good cover of tobosa grass (figs. 64 and 65). As a result, these soils have a high content of organic carbon, more than some Mollisols (see chapter 2). They are illustrated by Stellar 60-21 (figs. 64 and 65), which has one of the most prominent E horizons in the arid part of the study area, probably because of its basin-floor position, more moisture (from runoff) and a very stable surface. The Stellar soils have thick, fine-textured argillic horizons and thick K horizons. Thin sections (fig. 66) of the argillic horizon show no argillans on ped faces, but thick coatings of oriented clay (grain argillans) are on sand grains.

Pedon 60-17 illustrates the Reagan soils (figs. 67 and 68). These soils are slightly upslope from the Stellar soils and, as is common in such positions, occur in both grassy and barren strips (figs. 67 and 68). A silicate clay maximum occurs in the B horizon, but oriented clay cannot be seen in thin section because of a high content of carbonate (fig. 69). This pedon illustrates how a high content of carbonate can prevent development of the argillic horizon even though the soils formed partly in a Pleistocene pluvial, with its greater effective moisture.

Soils of the playa are illustrated by Dalby taxadjunct 60-16 (figs. 70 to 72). They are on the lowest part of the basin floor, which in some years is occupied by standing water for periods of several months during the rainy season. Because of the high content of clay, the soils have distinctive morphological features, such as slickensides and wedges (fig. 72). These features form as the soils shrink and swell during alternating wet and dry periods. During dry times, prominent cracks form in the soil surface (fig. 72).

Figure 64.—Landscape of the Jornada I surface and the Ustic Calciargids, Stellar soils. The vegetation is mostly tobosa with a few snakeweed and mesquite plants. The barren area in the foreground is spoil from the trench. This area receives runoff from both the San Andres Mountains to the east and the Dona Ana Mountains to the west. The San Andres Mountains are on the skyline. Photographed in February 1970.

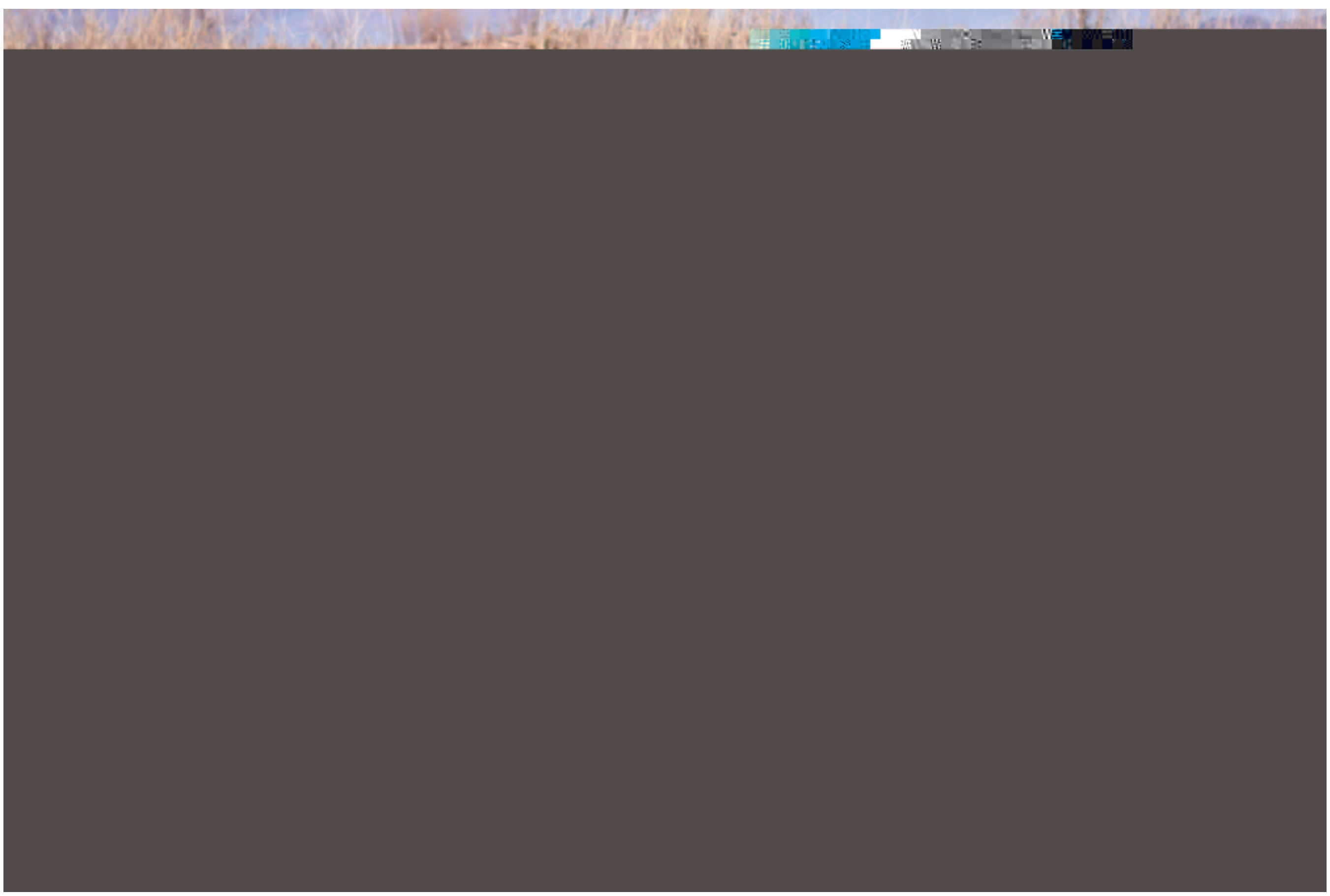

Figure 65.—The Ustic Calciargid, Stellar 60-21, in Jornada I sediments. Only the upper part of the thick K horizon is shown. The scale is in feet.

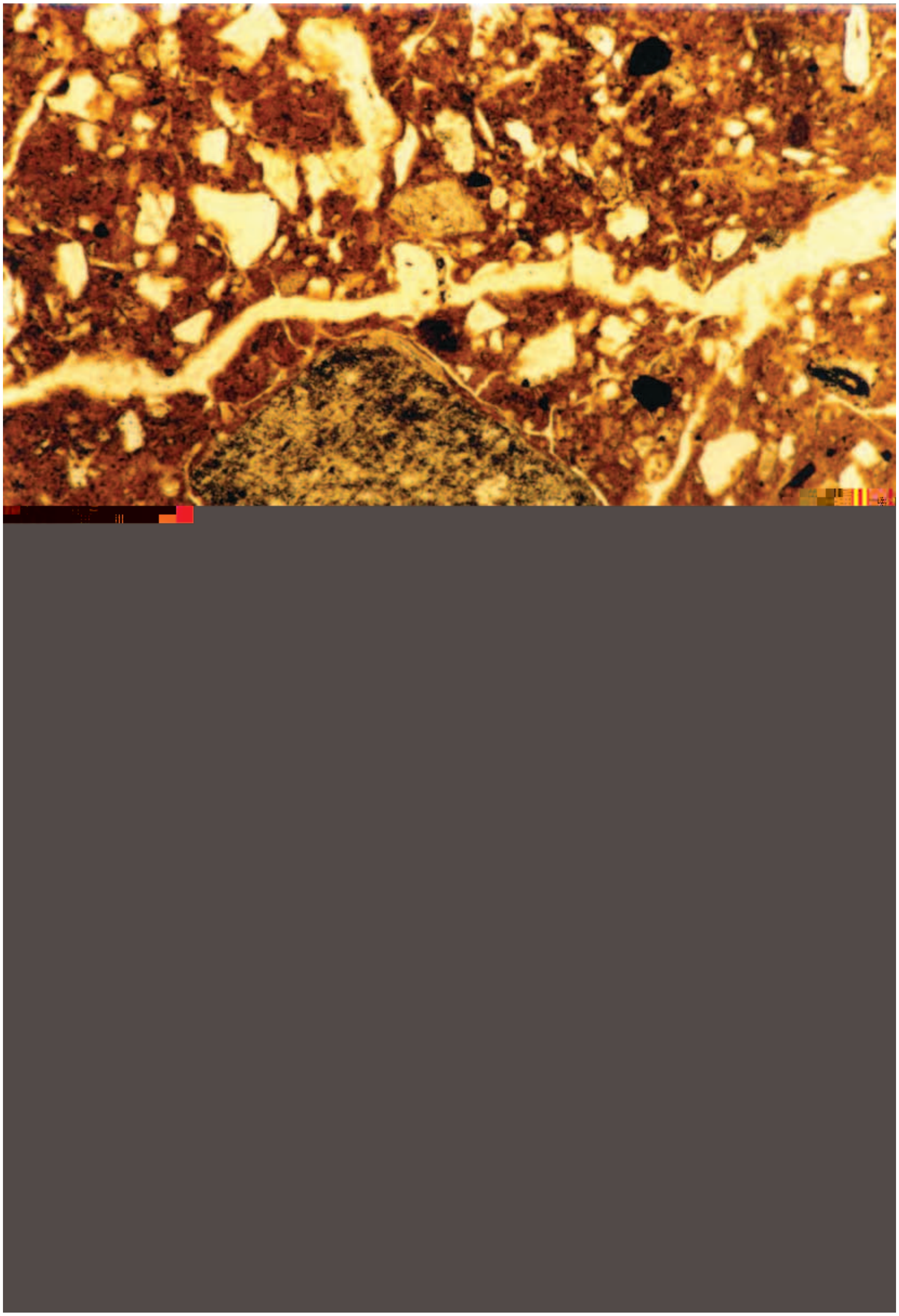

Figure 66.—Thin sections of the Bt3 horizon in the Ustic Calciargid, Stellar 60-21. Argillans do not occur on faces of peds, but they are common on sand grains, which are dominantly quartz and feldspar with minor amounts of rhyolite. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scales = 0.5 mm.

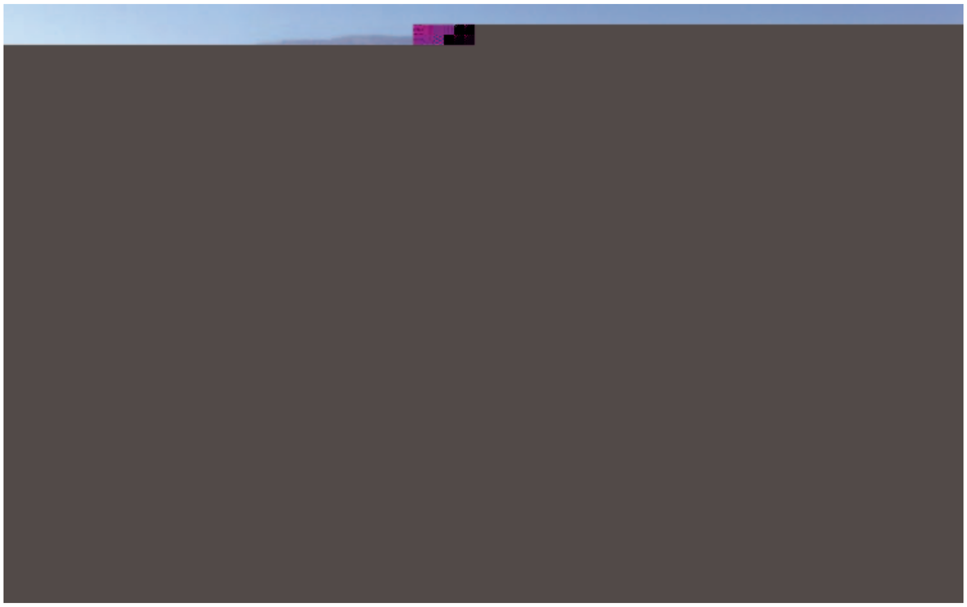

Figure 67.—Landscape of the Petts Tank surface and the Ustic Haplocalcids, Reagan soils. The vegetation is mostly burrograss with a few desert holly, sumac, and crucifixion thorn plants. The San Andres Mountains are on the skyline. Photographed in October 1970.

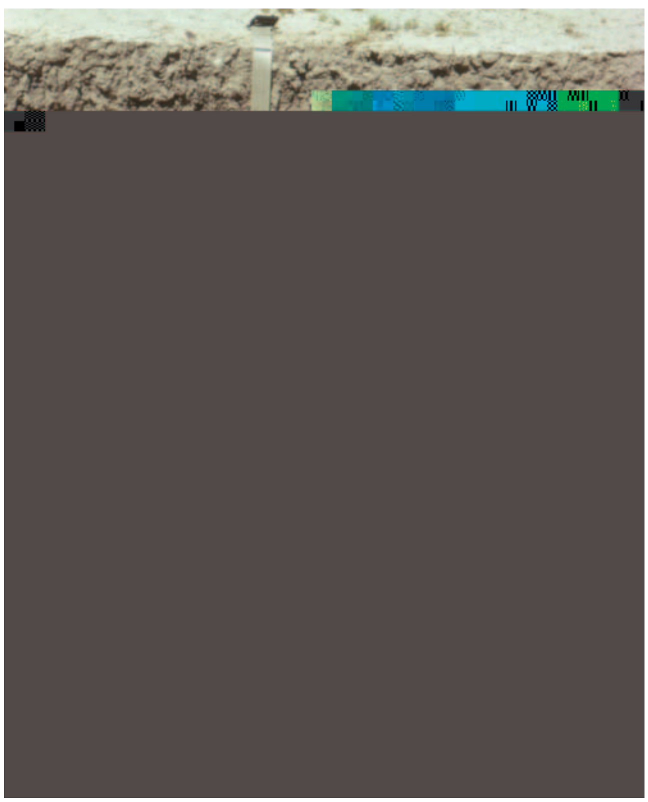

Figure 68.—The Ustic Haplocalcid, Reagan 60-17, formed in sediments of the Petts Tank surface. The top of a buried soil in Jornada I sediments is at a depth of 6½ feet. The scale is in feet.

Figure 69.—Thin section of the Bk3 horizon in the Ustic Haplocalcid, Reagan 60-17. Clay content increases markedly from A to B (table 71, Guidebook), but no argillans are evident because carbonate in the parent materials prevents them from forming. Light colored zones of K-fabric occur at the lower left and the upper right center. Sands are dominantly quartz and feldspars. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scales = 0.5 mm.

Figure 70.—Landscape of the Chromic Haplotorrert, Dalby taxadjunct, on the Lake Tank surface. The vegetation is blueweed. This soil occurs in the lowest part of the basin floor north of Highway 70. During the rainy season in some years, the playa is occupied by standing water for periods of several months. Photographed in October 1971.

Figure 71.—The Chromic Haplotorrert, Dalby taxadjunct 60-16. Because of a high clay content, this soil has distinctive morphological features—wedges, plates, and slickensides (fig. 72). The scale is in meters.

Figure 72.—Slickensides on a sample from the Dalby taxadjunct. Note the smooth, shiny surface of the sample. Cracks in the soil surface are visible at right; the cracks reflect drying of the clay below. Repeated wetting and drying and the associated shrinking and swelling of the soil are responsible for the development of wedges, plates, and slickensides in the soil.

Effects of Subsurface Moisture Concentration in the Arid Zone: Pipes

Some soils have roughly funnel-shaped, downward extensions of B horizons that are termed pipes. In low-gravel, low-carbonate parent materials, the pipes are commonly reddish brown and extend downward into or through carbonate horizons.

Pipes range in width from a few cm to 10 m or more. They are widest and most complex in the oldest soils. Prominent pipes have not been observed in Holocene soils; the greater effective moisture of Pleistocene pluvials must have been necessary for pipe formation. Pipes are a characteristic feature of soils ranging from late Pleistocene to late Pliocene in age and thus did not form all at once. They appear to be a normal feature of development and to have formed largely or wholly in pluvials, although carbonate in upper horizons probably accumulated in drier times. In the study area pipes are more common in nongravelly soils since gravelly materials tend to plug with carbonate more rapidly.

Pipes appear to form as a result of local concentration of water, in roughly vertical zones that are relatively pervious as compared to adjacent horizons. Some pipes may have been initiated by substantial differences in permeability resulting from animal burrowing and by the filling of cavities created when large roots decay (fig. 73). The fillings are coarser than adjacent horizons and appear to have been blown or washed in from nearby soils. When roots decay, the interior decays first, resulting in a void that is filled from above while the intact periphery of the root prevents filling from adjacent horizons. Eventually, the root decays entirely, resulting in roughly vertical volumes of material that is coarser textured and more pervious than the adjacent horizons. Water would infiltrate to greater depths in these volumes and tend to keep them low in carbonates. The funnel shape may result in part from the shape of a former root (fig. 73). It may also arise partly because the frequency of wetting is progressively less with depth. Because of their slow permeability, plugged and laminar horizons would deflect water into pipes and increase the depth of flushing.

Once initiated, at least some pipes persist throughout the history of a given soil, as is indicated by their presence in soils of all ages in the Pleistocene and by the fact that pipes increase in degree of development with increasing age. On the following pages, pipes of four ages are illustrated—Holocene, late Pleistocene, middle to early Pleistocene, and late Pliocene.

Pipes of Holocene Age

Prominent pipes have not been observed in Holocene soils. However, a small pipe of Holocene age occurs in a soil of late Pleistocene age (fig. 73)

Some pipes, such as the one shown in figures 73 to 76, have formed in fillings of cavities left by decay of large roots. Pieces of bark are still preserved around the periphery of the root. As the root gradually decayed, fine earth was blown or washed in from the surface and eventually filled the cavity with materials younger and more pervious than the adjacent horizons. That the pipe is of Holocene age is indicated by its abrupt boundary to the adjacent material, the stage I carbonate in the pipe, and remnants of bark. Pipes of Pleistocene age generally are larger, do not have the remains of roots, have deeper horizons of silicate clay and/or carbonate accumulation, and in nonindurated materials commonly do not have such abrupt boundaries to the adjacent materials.

Pipes of Late Pleistocene Age

Pipes of late Pleistocene age are much more prominent than the small, weakly developed Holocene pipe, as is illustrated in figure 57, which shows two pipes of a late Pleistocene soil buried by Isaacks' Ranch alluvium. These pipes show no connection to the present land surface and must have formed in the late Pleistocene.

Figure 73.—Landscape view of a Holocene pipe, at left of tape, in a late Pleistocene Typic Calciargid, Berino series. The Typic Calciargid, Berino 68-9, is at the right of the tape.

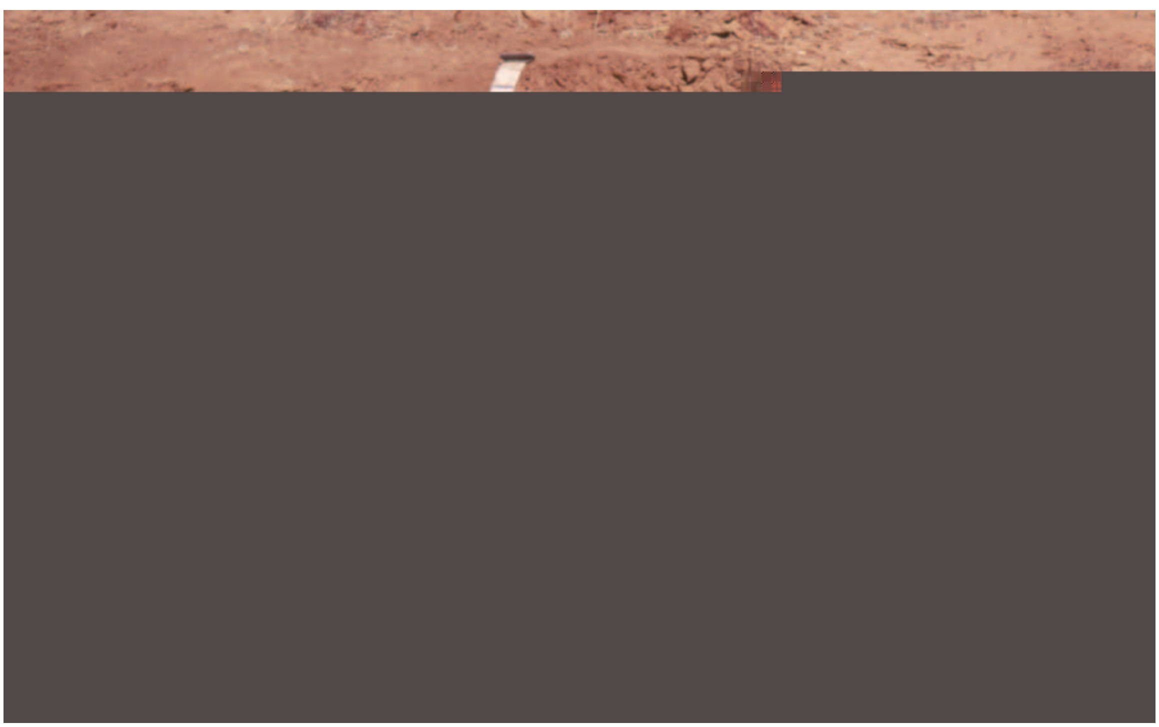

Figure 74.—View of the Holocene pipe, at right of the tape. Note position of knives. Closer views are shown in figures 75 and 76.

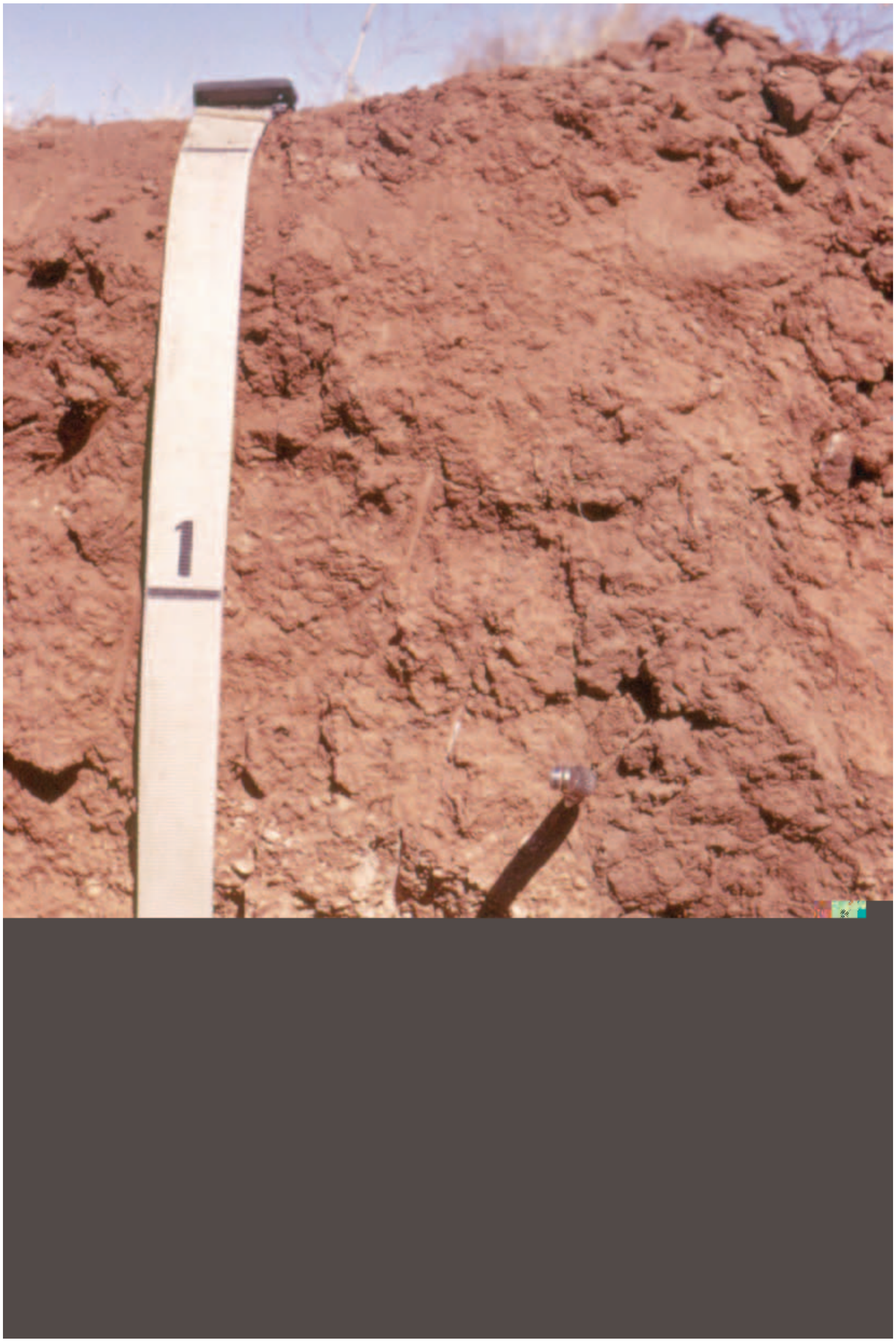

Figure 75.—A closer view showing the abrupt boundary, marked by the knife, between the pipe and the bordering material.

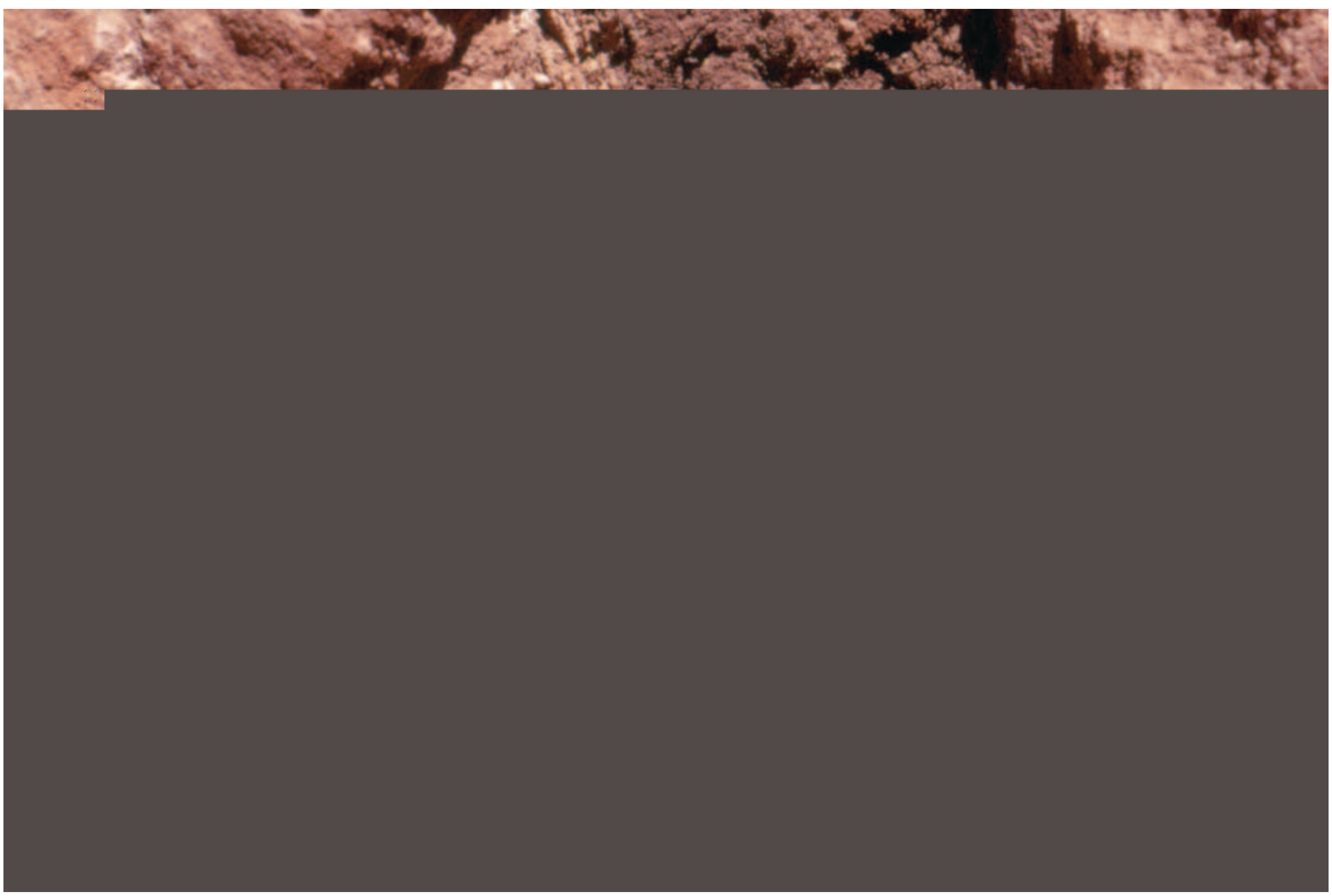

Figure 76.—The lower part of the pipe is much softer and has much less clay and carbonate than the adjacent high-carbonate horizon in which the knife is placed. Soil moisture penetrates to greater depths in the pipe than in the adjacent carbonate horizon. Once this pervious zone has formed, it constitutes a zone of preferred moisture movement to greater depths.

Pipes of Middle to Early Pleistocene Age

Most pipes in soils of La Mesa surface are much larger than they are in younger soils, and their roughly circular, funnel shape is more pronounced. A cutaway diagram (fig. 77) shows part of a pipe wall in a soil of the lower La Mesa. Note the slope leading into the pipe. Moisture does not reach the deep petrocalcic horizon at present, but it would have during pluvial times in the Pleistocene. The petrocalcic horizon constitutes a barrier to downward movement of soil water, and in pluvials it would have been the controlling factor in a subsurface drainage system that funneled soil water into the pipes. Figures 78 to 81 illustrate some of the features of pipes in soils of the lower La Mesa.

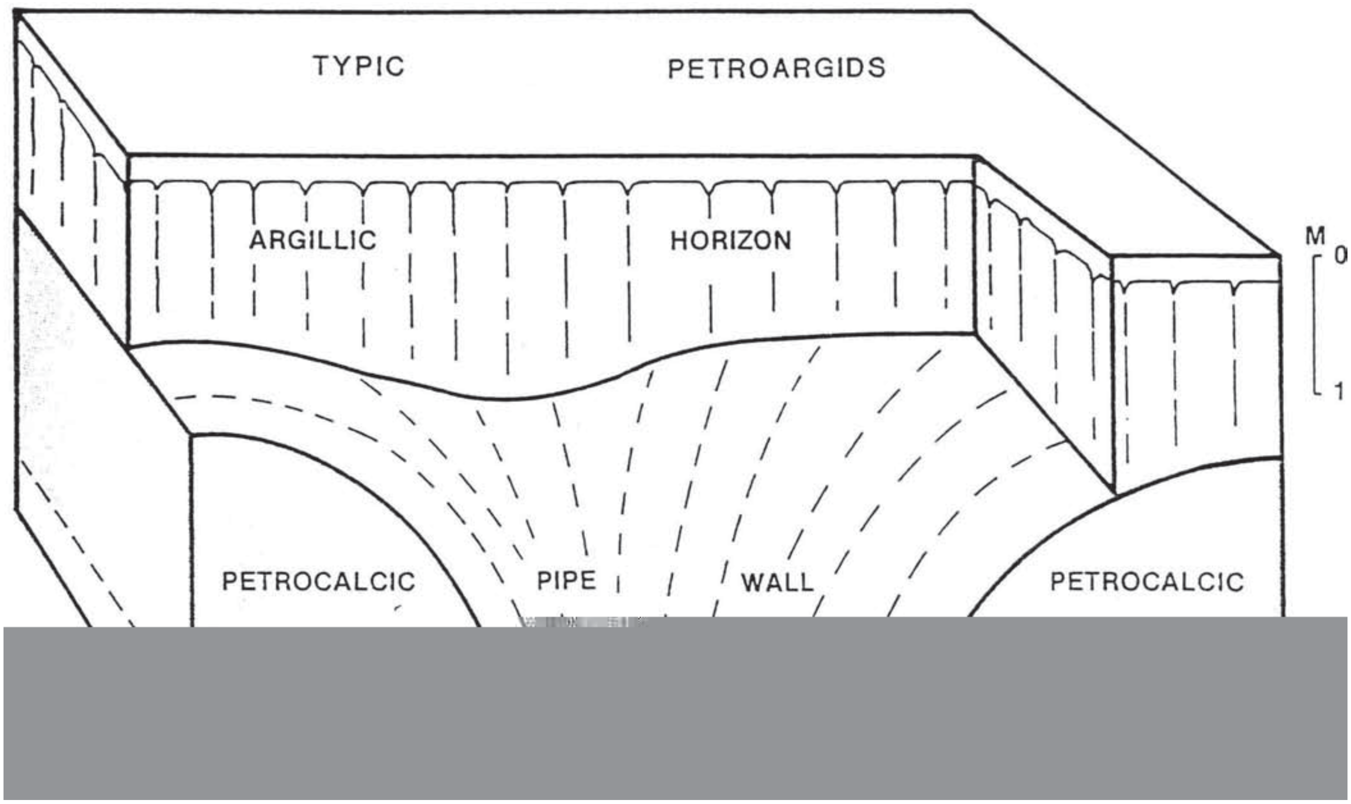

Figure 77.—Most pipes in soils of La Mesa are much larger than they are in younger soils, and their roughly circular, funnel shape is more pronounced. This generalized diagram shows part of a pipe in the lower La Mesa, where the soils are estimated to be about 780,000 years old (table 2).

Figure 78.—A landscape view of the lower La Mesa, west of the Rio Grande Valley. Typic Petroargids (Rotura soils) are dominant on this part of the lower La Mesa; Typic Torripsamments (Bluepoint soils) also occur in duned areas. Typic Haplargids (Sonoita soils) occur in pipes, such as the one exposed in the study trench. The edge of the trench is in the foreground. Photographed in April 1972.

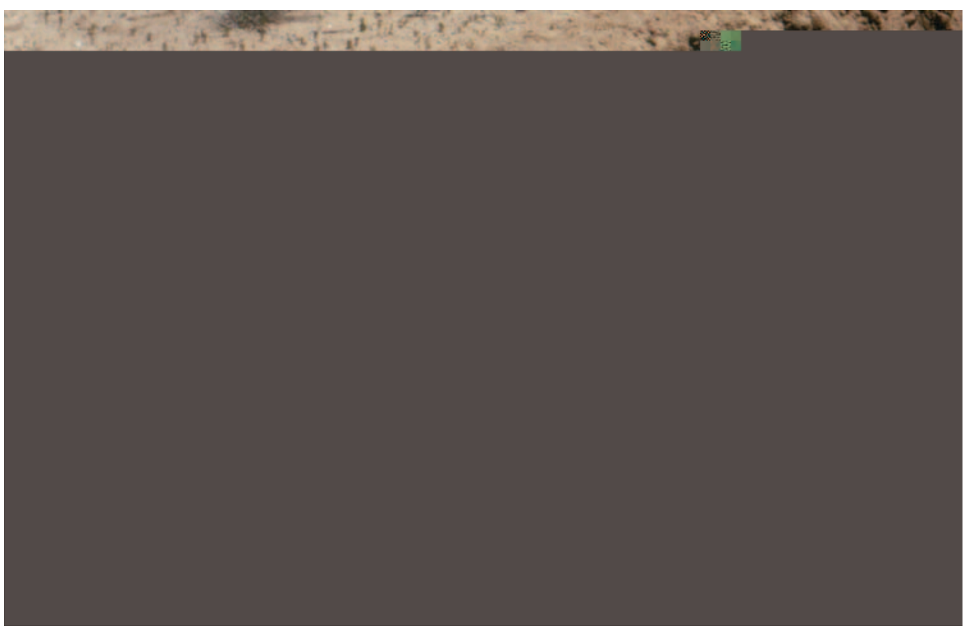

Figure 79.—At the lower left, the lower boundary of the pipe is marked by the sloping, light colored top of the petrocalcic horizon. At the right of the tape, the reddish brown pipe dips below the bottom of the trench and then rises and drops again at the far end of the trench. The Typic Haplargid, Sonoita 72-3, is in the pipe over most of the exposure. Where a petrocalcic horizon occurs, as it does at the tape and left of it, the soil is the Typic Petroargid, Rotura. The redder color in the center of the pipe reflects the zone of maximum leaching caused by funneling of water into the pipe by the adjacent petrocalcic horizon. The presence of Bt horizon material in the lower part of the pipe indicates that it must once have been free of carbonates. The scale is in feet.

Figure 80.—It is not possible to geomorphically demonstrate relative ages of carbonate in the pipe. Nevertheless, the carbonate morphology and depths are suggestive. A stage I carbonate horizon, consisting of a few carbonate filaments, starts at depth of about 9 inches. On valley-border terraces nearby, stage I carbonate first occurs in soils of late Holocene age. A stage II carbonate horizon, with carbonate nodules separated by low-carbonate material, starts at a depth of slightly less than 3 feet. On valley-border terraces, stage II carbonate first occurs in soils of the latest Pleistocene age (10,000 to 15,000 years ago). A thin stage III carbonate horizon is at the left, above the petrocalcic horizon. A thin stage III carbonate horizon also occurs in a late phase of the late Pleistocene Picacho surface along the valley border.

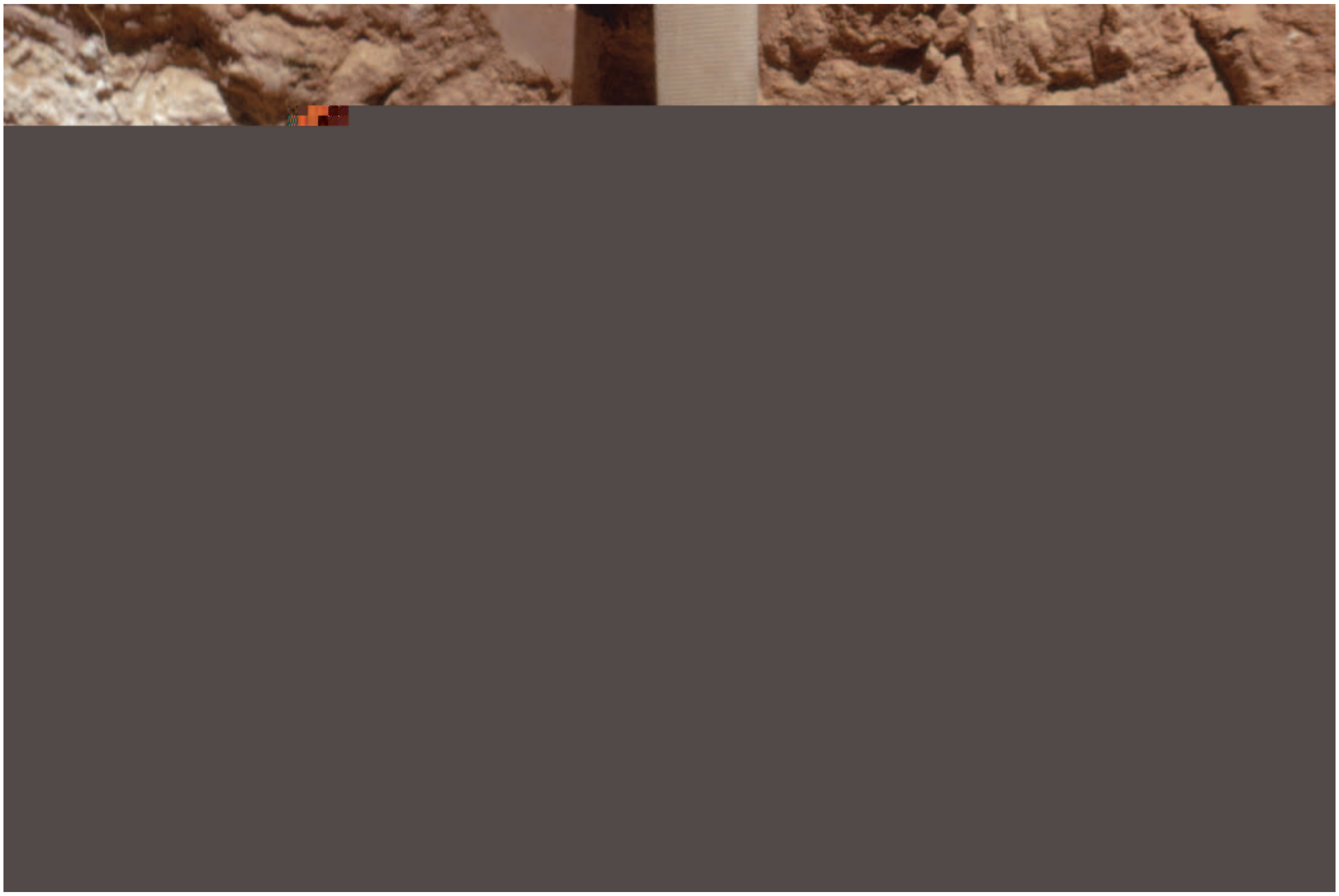

Figure 81.—A closer view of the top of the petrocalcic horizon. A thin, discontinuous laminar horizon occurs along the top of the petrocalcic horizon, as is typical of many lower La Mesa pipes. Laminar horizons are prominent in the older pipes of the upper La Mesa, to be discussed next.

Pipes of Late Pliocene Age

Because of their much greater age (table 2), pipes in the upper La Mesa soils (fig. 82) have morphologies much more complex than the pipes of the lower La Mesa. During the Desert Project studies of 1959-1972, these pipes were well exposed in the so-called “airport trenches” (fig. 83). The trenches were later filled during expansion of Las Cruces International Airport. However, the part of the right-hand trench (fig. 83) that contained the sampled pedons (pedon 68-8 in the pipe, and pedon 61-7 near the pipe) was reexcavated and will be permanently preserved. Figures 84 to 88 give views of both pedons and several parts of the pipe.

In 1987, the study trench was deepened so that more could be learned about the character of the lower part of the pipe. A thick Btk horizon in the lower part of the pipe extends to a depth of 284 cm, where it overlies a deep Km horizon (fig. 89). This thick Btk horizon and the Km horizon occur only in the lower part of the pipe and clearly must have formed as a result of deep leaching by water that was funneled into the pipe from the top of the adjacent petrocalcic horizon. Prisms in the Btk horizon are commonly coated with carbonate, but prism interiors are mostly noncalcareous.

Thin sections of the deep Btk horizon show some of the thickest grain argillans found in the study area (figs. 90 and 91). Prisms in the deep Btk horizon are very hard or extremely hard, do not soften noticeably when moistened, do not slake in water, and have very little clay. Thin sections of the lowest (Btk) subhorizon show part of a silica nodule (fig. 92). Silica is thought to be largely responsible for the hardness of the horizon, for its nonslaking property, and for cementation of the prisms. Tight packing, grain-to-grain contacts, and well developed grain argillans may also be contributing factors. The horizon does not qualify as a duripan because the prisms are moderate fine and medium and generally can be removed by the fingers; also, roots would readily penetrate the horizon.

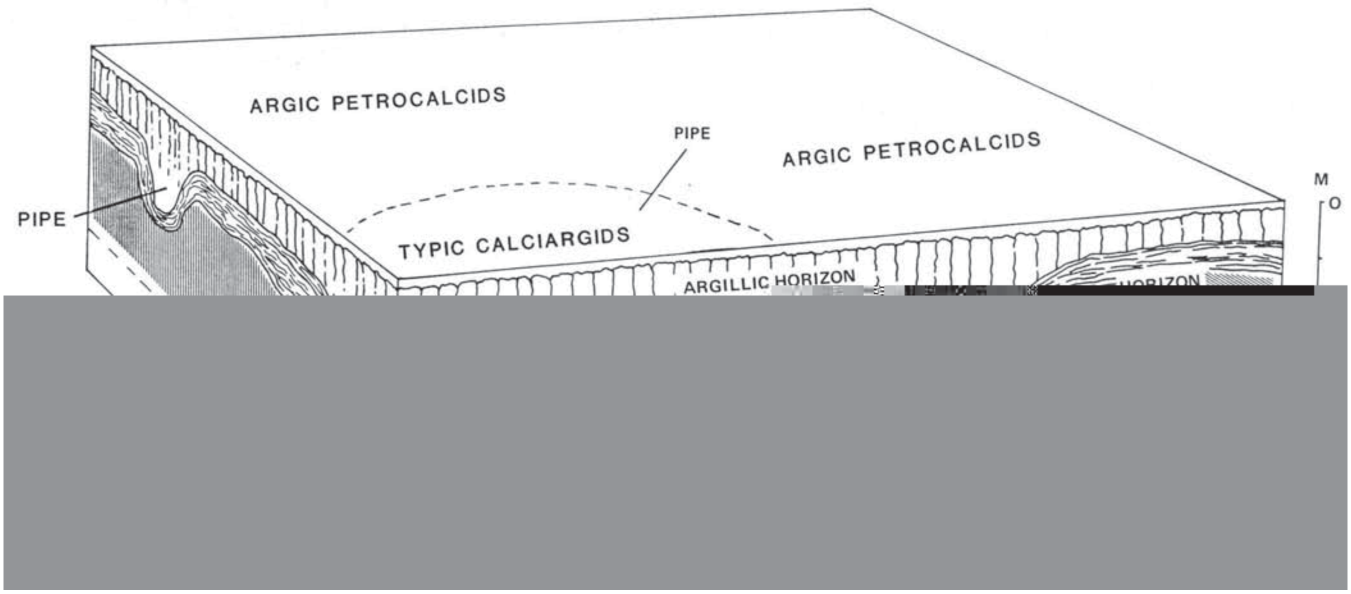

Figure 82.—A diagram showing the effect of large pipes on soil classification at the great group level. Calciargids occur in the pipes, whereas Petrocalcids are outside the pipes. Minor areas of Petroargids occur where depth to the petrocalcic horizon ranges from 100 to 150 cm.

Figure 83.—The so-called "airport trenches" in the upper La Mesa. Runways of Las Cruces International Airport are beyond the trenches. The pipe to be seen is exposed in the south bank of the right-hand trench. The Sleeping Lady Hills are on the skyline at right. Bob Ruhe stands at the junction of the trenches. Photographed in August 1959.

Figure 84.—The view in the right foreground shows the Argic Petrocalcid, Cruces 61-7, a typical soil between pipes. The Typic Calciargid, Bucklebar 68-8, is in the pipe at the left background. A spoil pile is on the surface at the right. Photographed in December 1968.

Figure 85.—The gradually sloping sides of the pipe. The pipe's edge at the left must have occurred between the petrocalcic horizon on the left side of the trench and the pipe at the right. Note that the top of the petrocalcic horizon at the right slopes directly into the pipe. During pluvials, substantial amounts of water must have been funneled into the pipe.

Figure 86.—A closer view of the stage III horizon. At right, the upper part of the stage III horizon merges with the upper stage IV laminar horizon, on which the small pickax rests. This mergence shows that the two horizons formed contemporaneously. It also illustrates the effect of depth to a plugged or laminar horizon on the morphology of accumulating carbonate.

Figure 87.—A closer view of the mergence zone between stage III carbonate, at left, and the stage IV laminar horizon, at upper right. C-14 ages on inorganic carbon were obtained for these two laminar horizons—the upper one, at upper right, and the prominent lower one. The upper laminar horizon dated at about 21,000 years and the lower one, 32,000 years. These relative ages agree with the morphological interpretation that the lower laminar horizon formed first and the upper one formed later. Interestingly, a C-14 date of about 21,000 years was also obtained from carbonate adhering to pebbles in the lower part of the carbonate horizon of the soil of late Picacho age mentioned earlier. This correlation does not demonstrate that the two carbonate horizons formed during the same general period of time, though they could have.

Figure 88.—A closer view of the Typic Calciargid, Berino 68-8, in the pipe. Stage I filamentary carbonate occurs from a depth of about 1$^1/_2$ to 2 feet. The nodular stage II carbonate horizon extends from about 2 to slightly less than 4 feet. A thin stage III carbonate horizon extends from less than 4 feet to the bottom of the tape. As noted earlier, a thin stage III carbonate horizon also occurs in a late phase of the valley-border Picacho surface. The carbonate accumulations at different depths in the pipe suggest at least three changes to progressively drier soil moisture regimes, probably resulting from changes in climate.

Figure 89.—The lower part of the pipe at pedon 68-8. A Btk horizon (directly above the Km horizon) is at a depth of 260 to 284 cm. Thin sections (figs. 90 to 92) are from this horizon.

Figure 90.—Thin section of Btk horizon in the Typic Calciargid, Berino, in the pipe. This horizon is at a depth of nearly 3 m and represents the very thick Bt horizon in the pipe. Grain argillans are prominent and are the thickest grain argillans found to date in the Bt horizons in the Desert Project. Grains are commonly in contact with several adjacent grains, contrasting with the "floating grains" of some of the other Bt horizons (e.g., the Bt horizon of the Haplocambid at area 3a). Grains are dominantly quartz, with some feldspar and volcanic lithics. *Upper*, plane-polarized light; *lower*, crossed polarizers. Bar scale = 100 µm.

Figure 91.—Thin section of the Btk horizon in the Typic Calciargid, Berino, in the pipe. Grains are dominantly quartz, with some feldspar. Argillans are prominent. Arrows locate laminated clay bridges. *Upper*, plane-polarized light; *lower*, crossed polarizers. Bar scale = 100 µm.

Figure 92.—*Upper:* Thin section of the Btk horizon in the Typic Calciargid, Berino, in the pipe, showing the margin of a silica nodule. The dominant fabric of the Btk horizon, at the upper left, has grain argillans and voids between them. Voids in the nodule below have been filled with silica cement. Grains are dominantly quartz, with some feldspar. Plane-polarized light. Bar scale = 0.5 mm. *Lower:* A closer view of the silica nodule shown above. Silica crystals on the grains are perpendicular to them, representing silica formation in place. The silica is outside the grain argillan, indicating that the argillan formed before the silica accumulated. Grains are mostly quartz. Crossed polarizers. Bar scale = 100µm.

Other Features of the Semiarid Zone

The effects of increasing precipitation in the semiarid zone were discussed earlier. This section presents a number of other soil and landscape features not found in the arid zone. Figure 30 and figures 93 to 106 locate and show some of these features. The features occur in Ice Canyon of the Organ Mountains and on the Jornada and Organ surfaces in the vicinity of Organ.

An Ustalfic Petrocalcid on the Dona Ana Surface in Ice Canyon

A distinctive soil, the Ustalfic Petrocalcid, Hayner 60-5, occurs on the Dona Ana surface at an elevation of 5,880 feet in Ice Canyon (figs. 93 to 96). This soil has an argillic horizon with texture of clay and a relatively deep (20 to 23 cm) E horizon, which has not been found elsewhere on the ridge crest. The E horizon is thought to be a remnant that elsewhere has been obliterated by prominent accumulations of silicate clay. Part of the Bt horizon contains 74 percent clay, much more than occurs in younger soils of the area. This soil is only on the narrow ridge crest and has not been found elsewhere in the Desert Project.

Thin sections show an unusual micromorphology (fig. 96). No argillans occur on ped faces, but prominent striae within peds suggest former ped surfaces with thick argillans. Prominent coatings of oriented clay, the characteristic features of Bt horizons in the Desert Project, occur on sand grains.

An Ustic Haplargid on the Organ Surface

Soils of the Organ surface in the semiarid zone illustrate initial development of two major diagnostic horizons, the argillic horizon and the mollic epipedon. Nearly all Holocene soils in the semiarid zone have thick, dark upper horizons. However, some of these thick, dark horizons do not have enough organic carbon for a mollic epipedon. The Ustic Haplargid, Summerford (figs. 97 to 99), is an example. Laboratory data for this soil are given in the *Supplement to the Desert Project Guidebook* (Gile et al., 1995b). The Summerford pedon has enough clay increase for an argillic horizon, and much of the clay in the horizon consists of grain argillans (fig. 99).

An Aridic Argiustoll of the Organ Surface

The Aridic Argiustolls (figs. 100 and 101) have both enough clay increase for an argillic horizon and enough organic carbon for a mollic epipedon. Thin sections show grain argillans in the Bt horizon of Onate 59-1 (fig. 102), which was the first pedon in the Desert Project to be sampled by the NSSL. Data are in *The Desert Project Soil Monograph* (Gile and Grossman, 1979).

An Ustic Haplargid of the Jornada Surface

The transition from Aridisols to Mollisols at an elevation of about 5,000 feet and above was discussed in the section “Additional Moisture Towards the Mountains.” This boundary can occur at or well above 5,000 feet and is commonly marked by the change from relatively stable Holocene soils to soils of Pleistocene age, most of which are much older than the Holocene and have undergone more erosion.

Figures 103 and 104 show a fan and soils of Jornada age (table 2). The Ustic Haplargid, Caralampi 60-9, was sampled at this site. Data are in *The Desert Project Soil Monograph* (Gile and Grossman, 1979).

An Ustic Haplargid of a Jornada Pediment

Seager (1981, p. 18) describes a broad pediment that extends east and west of San Agustin Peak. The pediment is about 8 miles across its widest part and is by far the widest pediment in the San Andres-Organ-Franklin mountain chain (Seager, 1981). The Ustic Haplargid, Monza 70-1 (fig. 105), has formed in this pediment.

The pediment occurs as a slight bedrock ridge sloping 5 percent. Lack of strong dissection and continuity of soils along the ridge suggest stability for a long time. The pediment is presumed to be older than Organ because Organ sediments are inset against it, and it is thought to fall within the Jornada range in age (table 2). Thin sections of the Rt horizon (fig. 106) show both illuvial clay and clay formed by weathering in place.

Figure 93.—A jackhammer, operated by Lee Gile, was used to dig through the petrocalcic horizon of the Ustalfic Petrocalcid, Hayner 60-5. The mesquite shrub at the lower right shows that mesquite, although not abundant on this ridge (fig. 29), had penetrated this semiarid area by 1959. Photographed by F.F. Peterson in 1959.

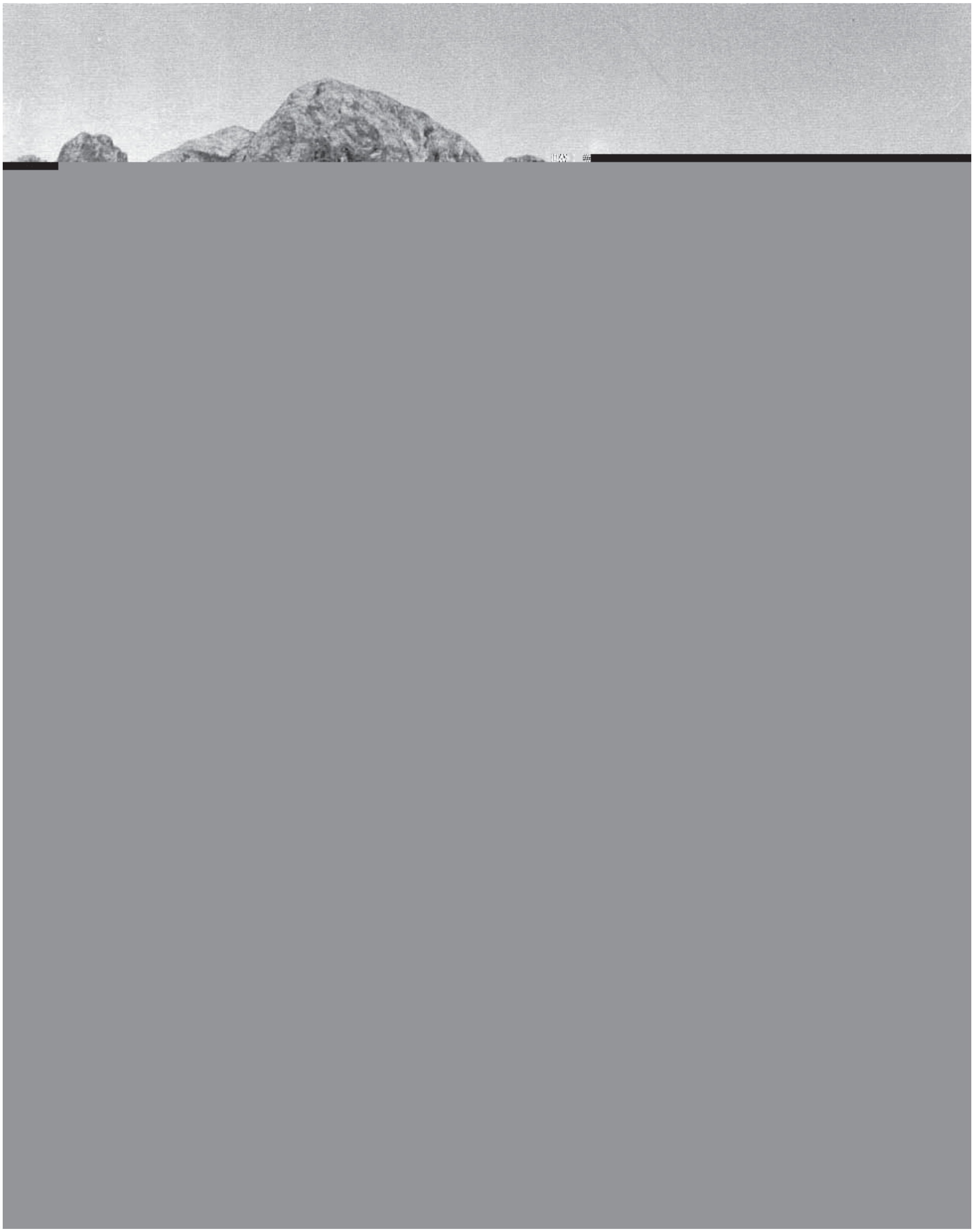

Figure 94.—Ice Canyon, the Organ Mountains, the Dona Ana surface, and the upper horizons of the Ustalfic Petrocalcid, Hayner 60-5, exposed in the foreground trench (see fig. 29). Baldy Peak, at an elevation of 8,445 feet, is on the skyline at left center. Photographed in March 1960.

Figure 95.—The Ustalfic Petrocalcid, Hayner 60-5. Note the red argillic horizon above the petrocalcic horizon, the top of which is directly below the 2-foot mark on the tape. Photographed in October 1961.

Figure 96.—Thin section of the Bty horizon in the Ustalfic Petrocalcid, Hayner 60-5. The horizon contains abundant clay (74 percent on a <2 mm basis). The matrix is clayey, with some rhyolite and quartz. Ped faces lack argillans, but oriented striae within peds suggest former argillans now within peds. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scales = 0.5 mm.

Figure 97.—Landscape view of the Organ surface, here dominated by the Ustic Haplargid, Summerford soil. A bedrock ridge of intermediate intrusives is in the middle ground, beyond the Organ sediments. The San Agustin Mountains are on the skyline. Photographed in February 1988.

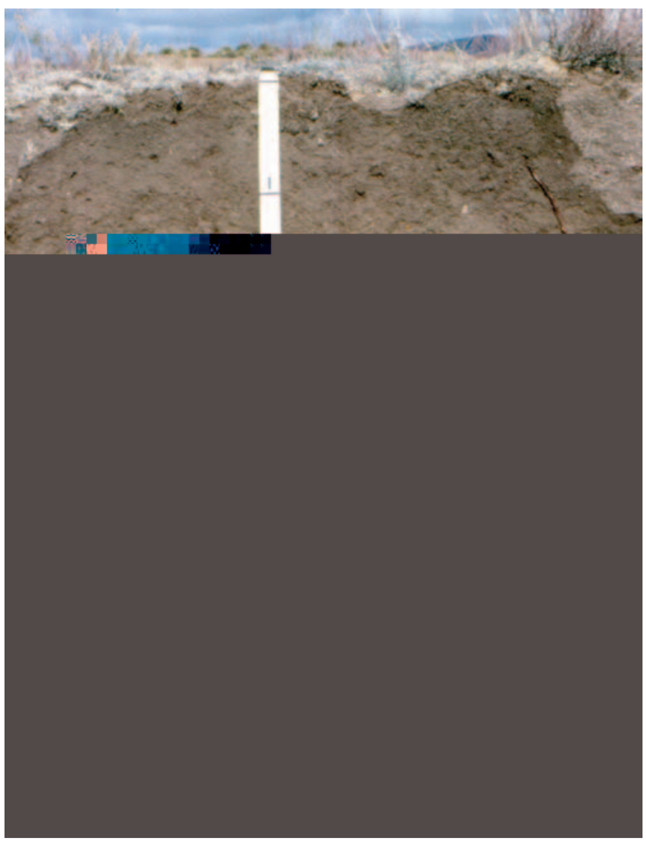

Figure 98.—The Ustic Haplargid, Summerford, formed in Organ alluvium. Data for this soil are in the *Supplement to the Desert Project Guidebook* (Gile et al., 1995b; study area 11c).

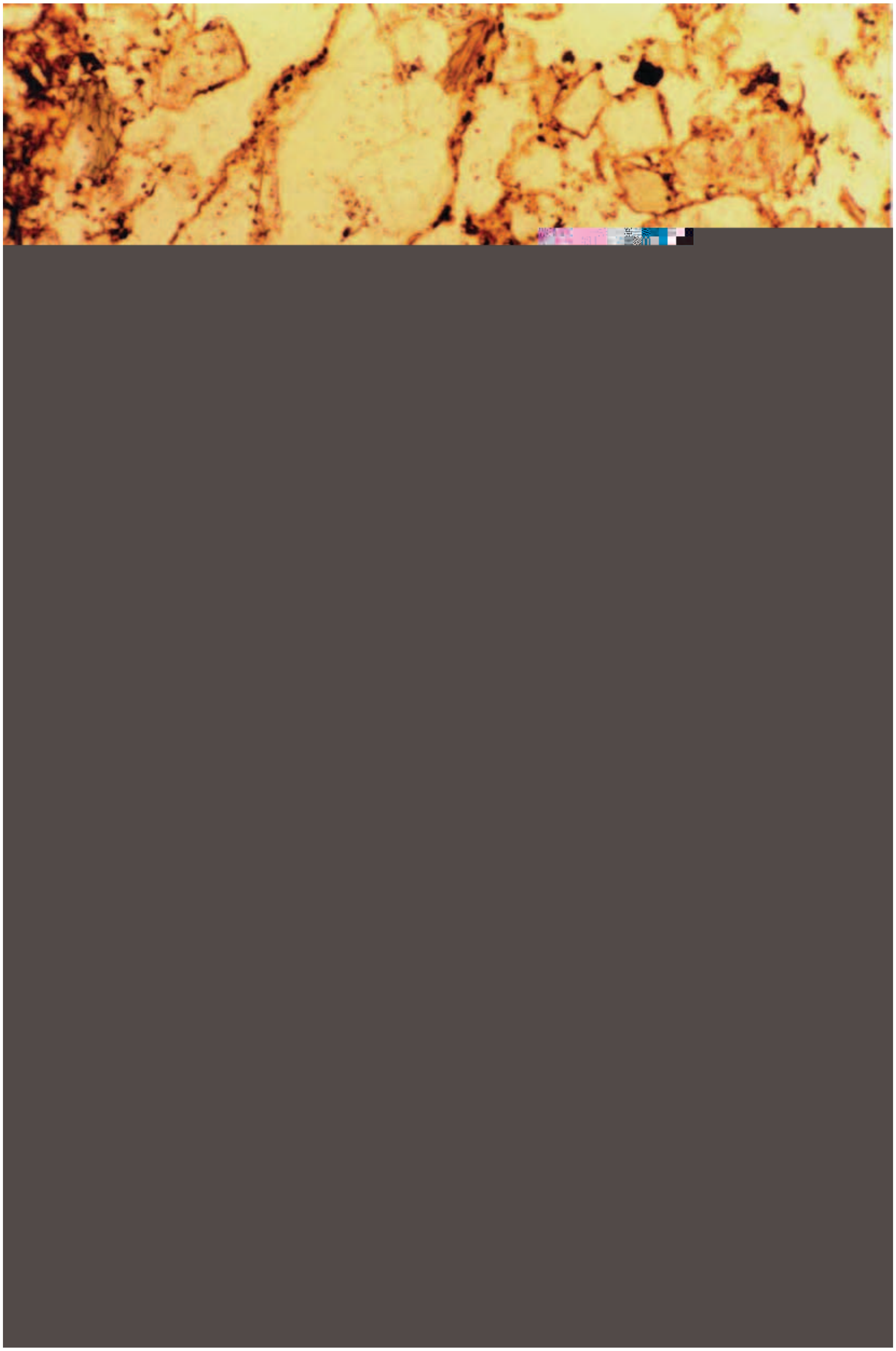

Figure 99.—Thin section of the Bt1 horizon in the Ustic Haplargid, Summerford. Thin grain argillans are common. Grains are primarily feldspar and quartz, with some rhyolite (lower center) and magnetite (center). *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

Figure 100.—Landscape view of the Organ surface soils, here dominated by the Aridic Argiustolls, Onate soils. San Agustin Pass is on the skyline. Photographed in June 1972.

Figure 101.—The Aridic Argiustoll, Onate 59-1, formed in sediments of the Organ surface.

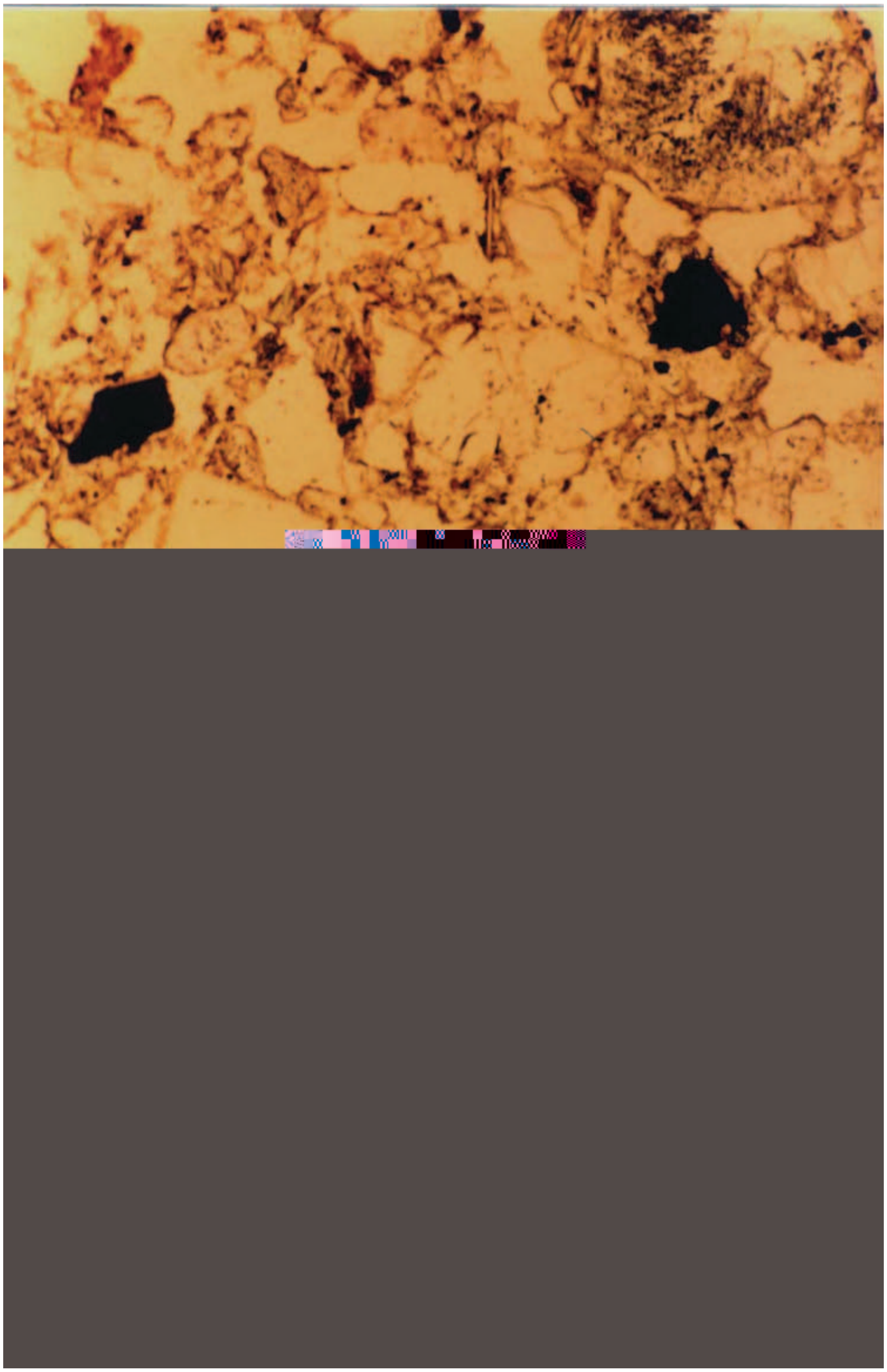

Figure 102.—Thin section of the Bt horizon in the Aridic Argiustoll, Onate 59-1. Sand grains are dominantly feldspars and quartz. Argillans are common on the sand grains. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scales = 100 µm.

Figure 103.—Landscape view of the Jornada surface and soils, dominated by the Ustic Haplargids, Caralampi soils. The top of a mine pit is in the middle ground at right. San Agustin Peak is in the center of the skyline. Photographed in April 1960.

Figure 104.—The Ustic Haplargid, Caralampi 60-9, is at left in this mine pit near Organ. Bob Grossman, at left, and Lee Gile are sampling the pedon. The Organ Mountains are on the skyline.

Figure 105.—*Upper:* Landscape view of a Jornada pediment cut in intermediate intrusive rock. Here the pediment is dominated by the Ustic Haplargids, Monza soils. The San Agustin Mountains are on the skyline; San Agustin Peak is at right. Photographed in October 1971. *Lower:* The Ustic Haplargid, Monza 70-1, in the bedrock pediment. Classification has changed from Ustollic to Ustic Haplargid since the photograph was taken. See figure 106 for micromorphology of a similar pedon nearby. Scale is in meters.

Figure 106.—Thin section of the Rt horizon in the Jornada pediment. Plagioclase (p) is at left; exfoliating biotite (b) is at right. The arrow locates clay *formation* along cleavage plane in biotite; clay caused by *illuviation* is shown along a fracture in the plagioclase at left. *Upper,* plane-polarized light; l*ower,* crossed polarizers. Bar scale = 0.5 mm.

Soils Dated by Radiocarbon Ages of Buried Charcoal

Buried charcoal dated by radiocarbon has been very useful in studying soil and geomorphic events of the middle and late Holocene. The dated charcoal and soil-geomorphic tracing have demonstrated the extensive occurrence of Holocene deposits and soils along the valley border, the coalescent fan piedmont, and the mountain front. The Gardner Spring, Isaacks, Shalam Colony, and Fillmore Arroyo radiocarbon sites illustrate buried charcoal that has been dated (consult the Desert Project guidebook and its supplement (Gile et al., 1981 and 1995b) and *The Desert Project Soil Monograph* (Gile and Grossman, 1979) for details on these sites and others presented in this book). The reasons for the fires that made the charcoal are generally not known, but at least some of the sites appear to be buried hearth sites (see the Fillmore Arroyo radiocarbon site).

The Gardner Spring Radiocarbon Site (High-Carbonate Parent Materials)

The Gardner Spring site is located in the White Sands Test Facility (WSTF) north of Organ (figs. 107 and 108). Nine lenses of charcoal have been dated at this site (fig. 109), where the soils have formed in high-carbonate materials derived from sedimentary rocks of the San Andres Mountains, along with admixtures of rhyolite, granite and quartzite. The dated charcoal shows that soils formed in Organ III alluvium must be less than 1,100 years old; soils formed in Organ II alluvium must be at least 1,100 years old but cannot be older than 2,100 years; and soils formed in Organ I alluvium are at least 2,200 years old but are not older than about 4,600 years (fig. 109). Figures 110 to 122 illustrate soils in the three kinds of alluvium.

Stage I carbonate, occurring as filaments and as coatings on sand grains and pebbles, is the most prominent feature of pedogenesis in soils of all three ages. It is most distinct in the soils of Organ I, the oldest. Soils of all three ages have abundant carbonate throughout, and no reddish brown Bt horizon has formed, as it has at the Isaacks' radiocarbon site, to be discussed later.

Four soils were sampled at the Gardner Spring site (nos. 1-4, fig. 108). Buried charcoal was dated at three of the four sampling areas as well as another area directly east of Apollo Blvd. (no. 5, fig. 108). Good stratigraphic control is available at all five areas because of numerous exposures in the walls of Gardner Spring Arroyo and nearby gullies. Additional control was provided by pipeline exposures associated with the construction of WSTF in 1963. All of these factors combine to make the Gardner Spring site truly unique. In 1980, in recognition of the uniqueness of this site, WSTF agreed to permanently fence and preserve the five areas shown in figure 108. Each sampled pedon is located and identified by a bronze marker set in cement, flush with the soil surface. Each fenced area is marked with aluminum signs on the wire, identifying the site and, at the sample sites, the NSSL sampling number. Thus, these distinctive areas are now permanently available for study and training purposes and are preserved for future generations.

Figures 110 to 122 show photographs of soils and landscapes at most of the charcoal sites, beginning with the youngest (charcoal horizon no. 3, dated at 1,130 ± 90 years BP). In addition, figure 121 and 122 show one of the oldest metates in the area; it was found in the same layer that had charcoal dated at 6,400 ± 110 years BP.

Figure 107.—Location of the Gardner Spring radiocarbon site (the rectangle designated GSR) west of the San Andres Mountains. The site occurs in an interfan valley of Holocene age between two large Pleistocene fans, one from Lohman Canyon and the other from Bear Canyon. The San Andres Mountains have large areas of calcareous sedimentary rocks, contributing high-carbonate parent materials for soil development. Aerial photograph taken in 1936.

Figure 108.—Location of the five fenced areas that will be permanently preserved at the Gardner Spring radiocarbon site, in the White Sands Test Facility north of Organ. These five areas have charcoal and/or soils sampled by the National Soil Survey Laboratory (NSSL). Fenced area 1, at left, contains pedon 65-1, formed in Organ I alluvium and analyzed by the NSSL. Fenced area 2 contains charcoal horizons 1, 7, and 8 and pedon 65-2, analyzed by the NSSL. Fenced area 3 contains pedon 65-3, analyzed by the NSSL. Fenced area 4 contains charcoal horizon 6 and pedon 65-4, analyzed by the NSSL. Fenced area 5 contains charcoal horizons 2, 5, and 9. Charcoal horizon 3, now obliterated, was directly south of fenced area 5; and charcoal horizon 4, also obliterated, was directly south of fenced area 2. See figure 109 for a list of charcoal horizons 1 to 9.

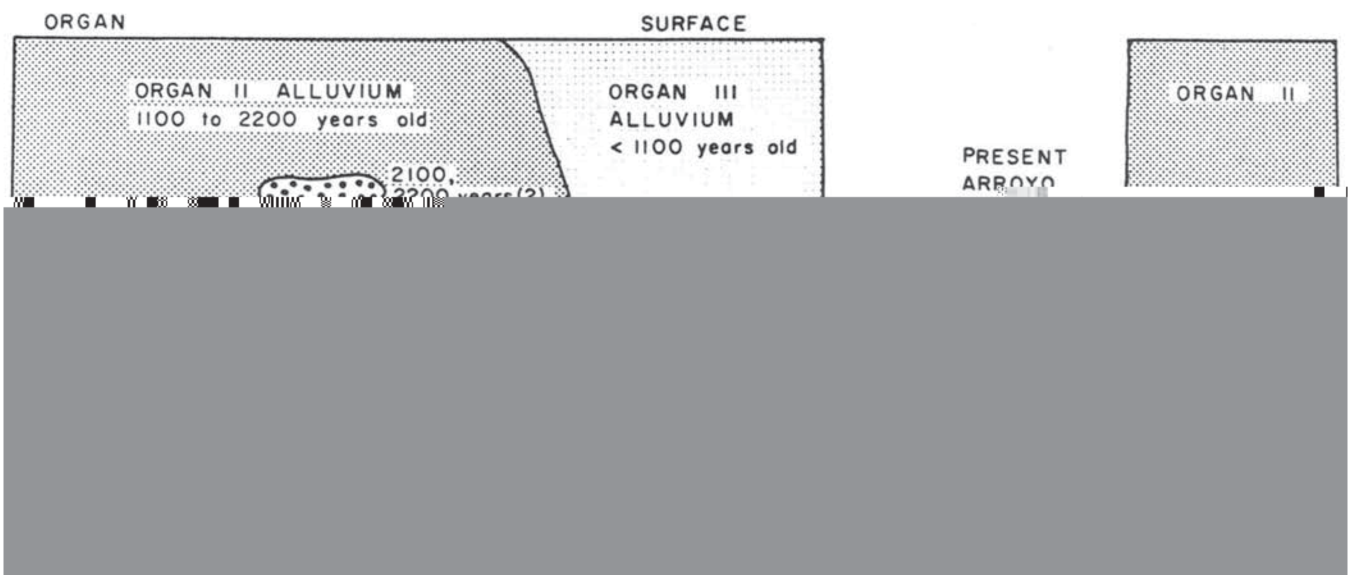

Figure 109.—Diagram of the chronostratigraphic relations of deposits and buried charcoal horizons at the Gardner Spring radiocarbon site. The actual dates and charcoal horizon numbers are as follows:

Charcoal horizon number	*Alluvium and radiocarbon age, years BP*
	Lower part of Organ III
3	**1,130 ± 90**
	Base of Organ II
1	**2,120 ± 110**
7	**2,220 ± 95**
	Middle to lower part of Organ I
2	**4,640 ± 180**
5	**4,700 ± 120**
6	**4,570 ± 120**
4	**4,960 ± 130**
8	**6,400 ± 110**
9	**4,850 ± 60**

Figure 110.—Landscape view of the Organ III channel fill. The contact of Organ III and Organ I alluvial sediments can be seen rising to the right. Beyond the right edge of the photograph, Organ III alluvium also cut Organ II alluvium where it overlies Organ I alluvium. The Organ III channel fill was obliterated during excavations associated with construction of the White Sands Test Facility. Charcoal horizon 3 is at the tape on the left. Photographed in March 1959.

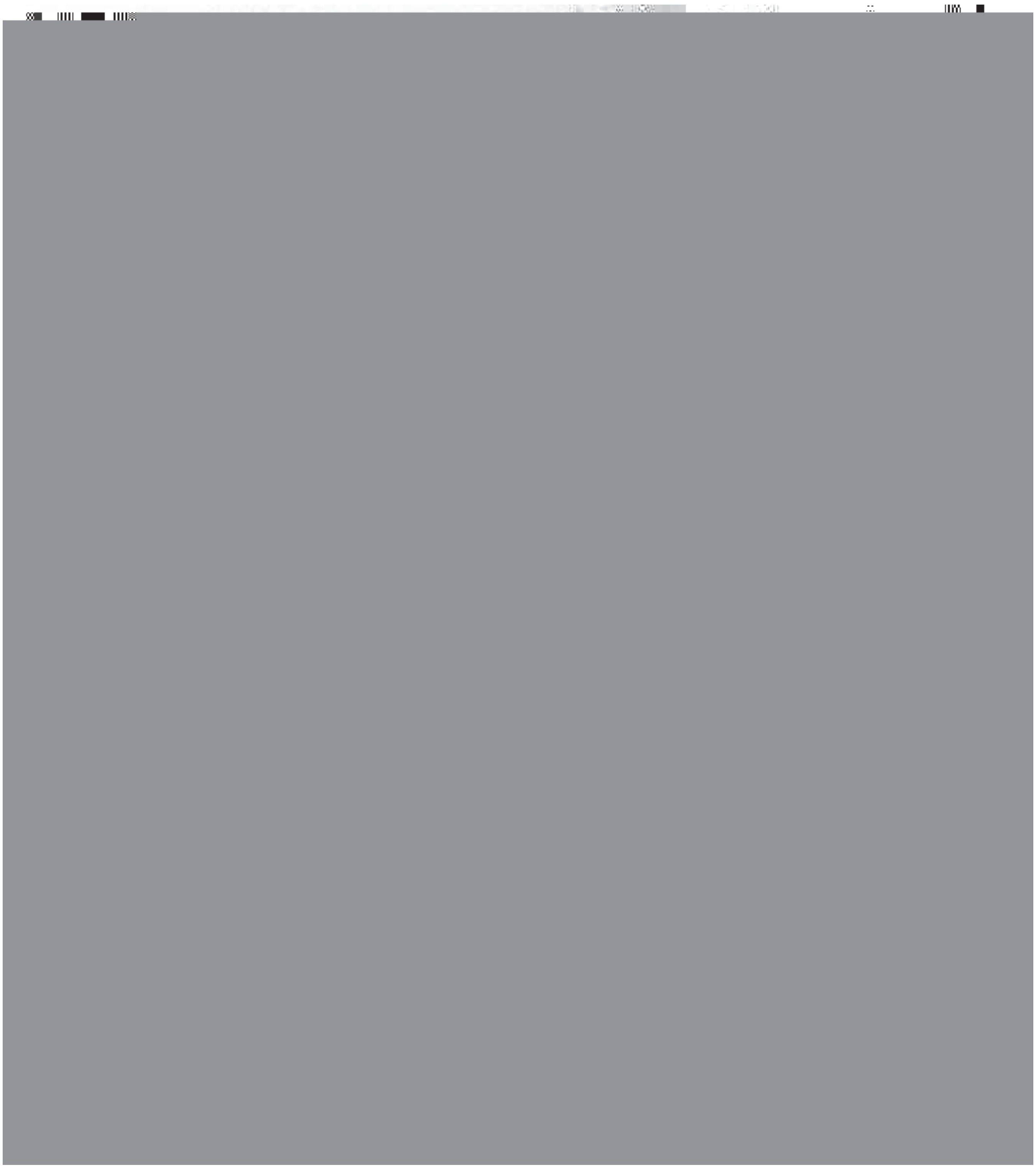

Figure 111.—The Typic Torrifluvent, Anthony, and charcoal horizon 3, dated at 1,130 ± 90 years BP. Weak stage I carbonate occurs as a few filaments and thin, discontinuous pebble coatings. The charcoal occurs at a depth of 130 to 140 cm. The scale is in feet. Photographed in March 1959.

Figure 112.—Landscape view of charcoal horizon 7 and the Typic Torrifluvent, Anthony, loamy-skeletal analog 65-2, in the interfan valley fill exposed in the north wall of Gardner Spring Arroyo.

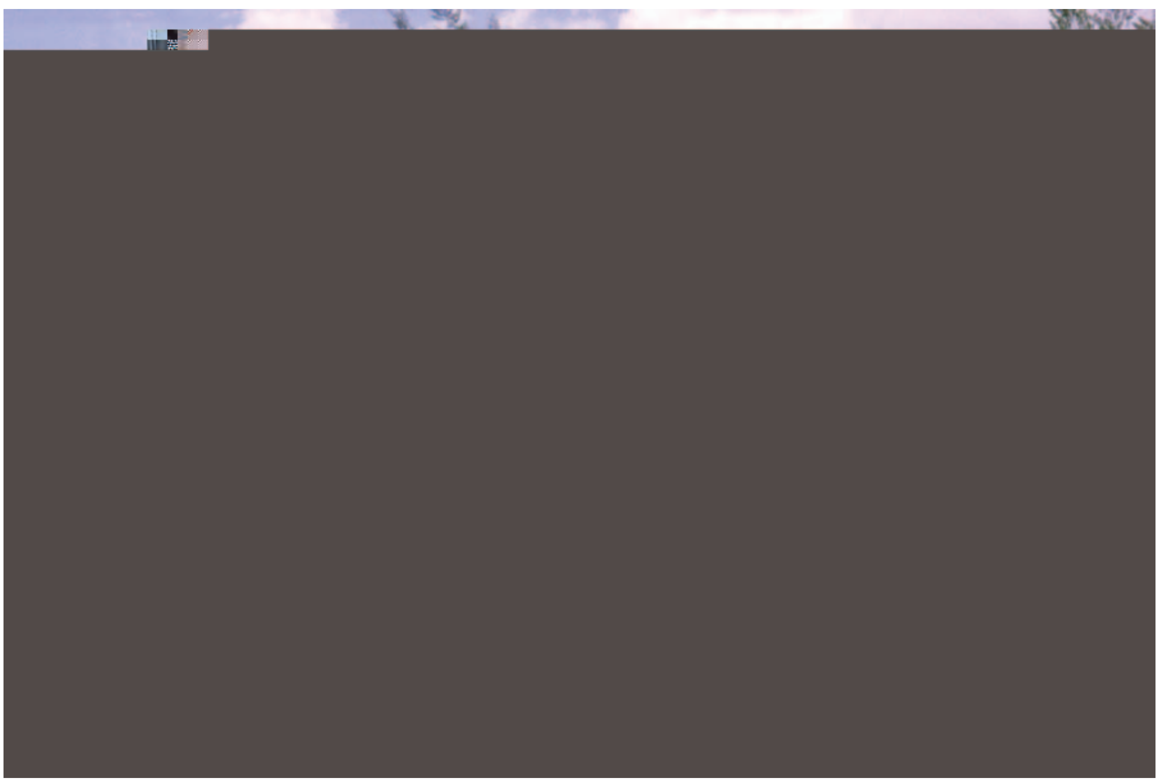

Figure 113.—View of Organ II alluvium, which extends to a depth of slightly more than 3 feet, and the underlying, less gravelly Organ I alluvium. Charcoal horizon 7 (at the extreme right) was discovered during preparation of 65-2 for sampling. The charcoal horizon, dated at 2,220 ± 95 years BP, was about 60 cm wide and extended from about 75 to 110 cm. The base of the charcoal zone rested on the buried soil in Organ I alluvium. Scale is in feet. Photographed in October 1965.

Figure 114.—Landscape view of the interfan valley fill that contains charcoal horizon 5. The Jornada I fan from Bear Canyon is on the skyline. The view is north. Photographed in July 1965.

Figure 115.—A closer view of charcoal horizon 5, at the bottom of the tape at right. Gravelly Organ II alluvium overlies the less gravelly Organ I alluvium.

Figure 116.—Buried charcoal, dated at 4,700 ± 120 years BP, is at the left of the bottom of the tape. Organ II alluvium occurs to a depth of 2 feet and has stage I carbonate with thin coatings on pebbles. The buried soil in Organ I alluvium has a structural B horizon with weak prismatic and subangular blocky structure and a very few carbonate filaments on faces of peds.

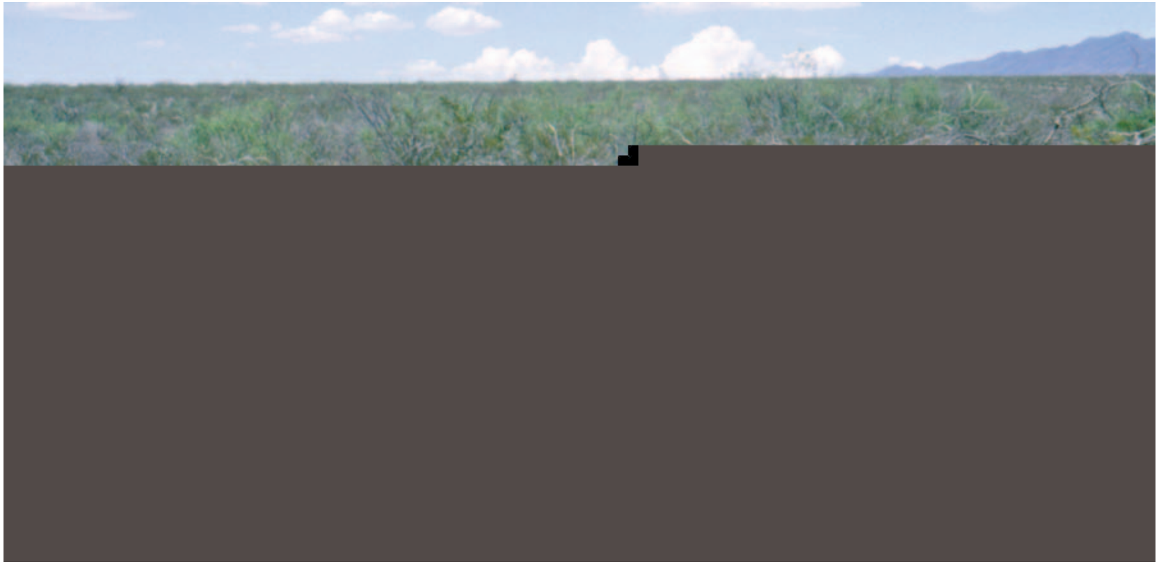

Figure 117.—Landscape view of charcoal horizon 6, in a side valley that extends from Gardner Spring Arroyo into the dissected Jornada fan just north (fig. 108). The dated charcoal and tracing from the arroyo just south shows that Organ I alluvium extends into the side valleys. The Typic Torrifluvent, Anthony 65-4, was sampled at a stable site at left. The view is north. Photographed in September 1965.

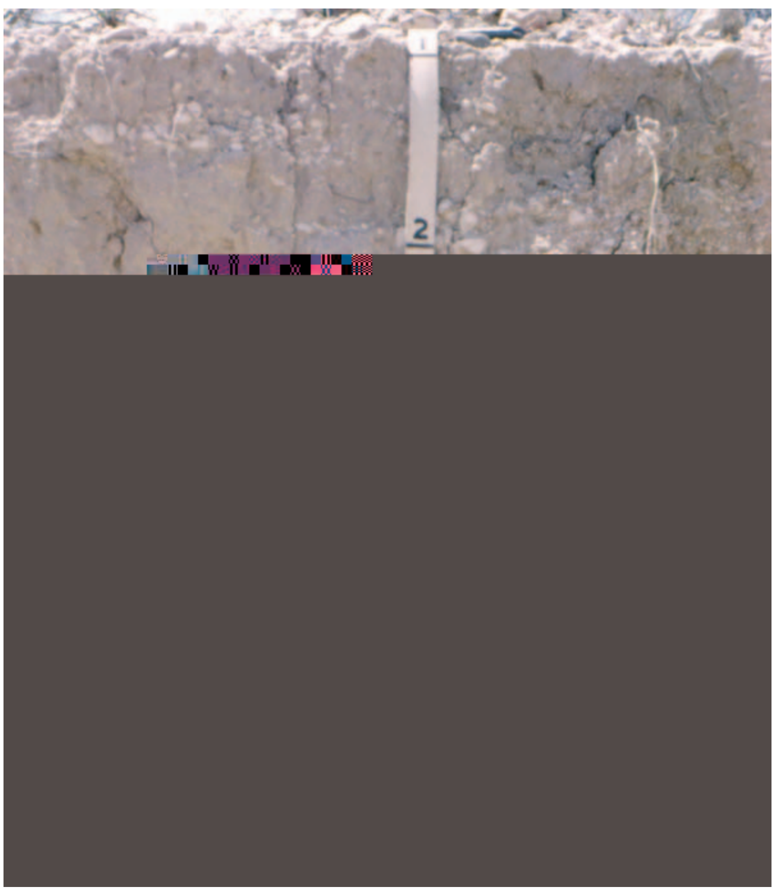

Figure 118.—Buried charcoal, dated at 4,570 ± 120 years BP, between depths of 4 and 5 feet. Stage I carbonate, with continuous carbonate coatings on pebbles, is evident in the upper horizons. Scale is in feet.

Figure 119.—Landscape view of charcoal horizon 8 and the Typic Torrifluvent, Anthony, in the interfan valley fill exposed in the north wall of Gardner Spring Arroyo. Charcoal horizon 8 is below the tape at left. Photographed in January 1969.

Figure 120.—Charcoal horizon 8 is below the tape and was dated at 6,400 ± 110 years BP. A metate was found in the same layer. The scale is in feet.

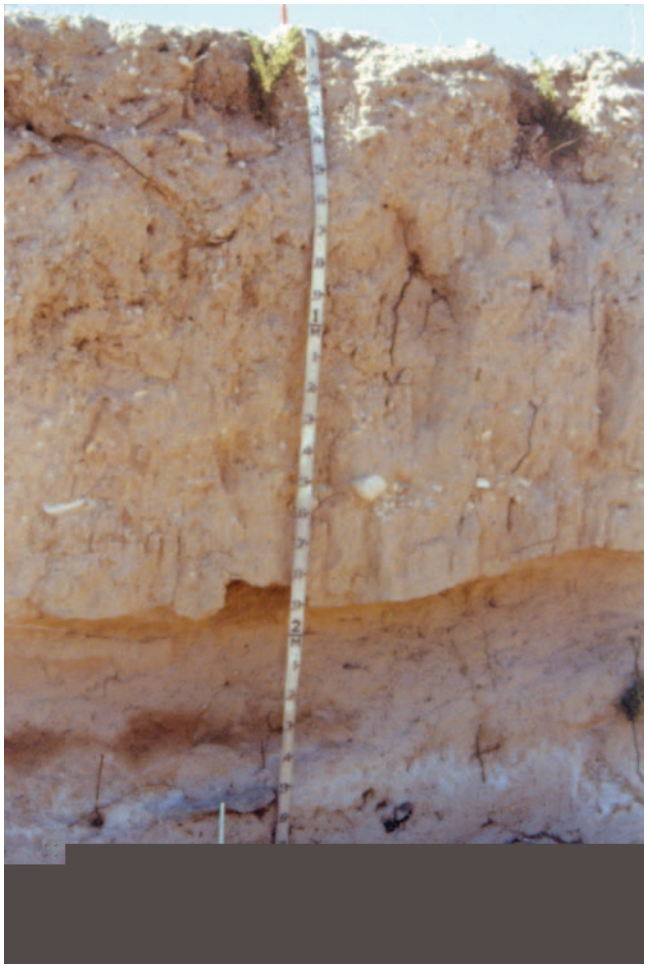

Figure 121.—View of metate in the same layer as the charcoal dated at 6,400 ± 110 years BP (fig. 109). Scale is in meters. Photographed in October 1971.

Figure 122.—Closeup of the metate shown in figure 121. The metate is one of the oldest found in the area. It is in the Chihuahuan tradition, which ranges from 7,000 to 2,000 years BP (Pat Beckett, personal communication, 1999).

The Isaacks' Radiocarbon Site (Low-Carbonate Parent Materials)

Figure 123 locates the Isaacks' radiocarbon site, on the fan piedmont north of Highway 70. Figures 124 and 125 are a soil map and cross section from Organ alluvium at the radiocarbon site to a ridge of late Jornada II alluvium just south.

Two charcoal horizons have been dated at this site in Organ alluvium (figs. 124 and 125). Here the soils have formed in low-carbonate materials derived from monzonite. One of the charcoal horizons was dated at 4,035 years BP and the other at 4,200 years BP. The first (no. 1, figs. 126 and 127) was on the edge of a gully and had been truncated by erosion. A stabler site was selected for sampling (no. 2, figs. 128 and 129), and much more charcoal was found there. The charcoal was in C horizon material beneath stage I carbonate and an overlying noncalcareous, reddish Bt horizon (fig. 129). Thus, these pedogenic features must be less than 4,200 years old.

This soil could be nearly 4,200 years old if the alluvium above the charcoal was deposited soon after the fire that made the charcoal. However, it is tentatively considered to fall within the age range of Organ II alluvium (1,100 to 2,100 years old) and to correspond to the younger part of the extensive Fillmore alluvium along the valley border.

Thin sections (fig. 130) show that nearly all of the clay in the Bt horizon occurs as oriented coatings on sand grains. Although the content of clay does not increase enough from A to Bt horizons for an argillic horizon in this soil, laterally the parent materials contain more clay, and there the Bt horizons do have enough increase in content of clay for an argillic horizon. Thus, a weak argillic horizon can form in late Holocene time in low-carbonate parent materials that contain enough clay.

In the Ck horizon, thin stage I carbonate coatings, or grain calcitans, occur on sand grains and pebbles (fig. 131). This expression of stage I carbonate is characteristic of soils of late Holocene age.

The Typic Calciargid Yucca 88-2, occurs on the ridge of late Jornada II age, directly south of the Organ deposit (fig. 132). Data and discussions are in Gile et al. (1995b). This study trench is a few meters east of the one shown in the 1971 photograph in the section on repeat photography (fig. 19). Yucca 88-2 is on the narrower part of the ridge where pipes are less numerous; only one small one is evident, on the east end of the trench.

In contrast to the Haplocambid in Organ sediments, this soil has an argillic horizon and a K horizon. Thin sections of the Bt horizon show that the coatings of oriented clay, or grain argillans, are thicker than those in the Haplocambid (fig. 133). Also, less void space is evident, and more clay-rich material occurs in the matrix between the grain argillans.

In the Btk horizon, carbonate is in the process of engulfing formerly continuous Bt material (fig. 134). In contrast, carbonate occurs throughout the underlying K horizon.

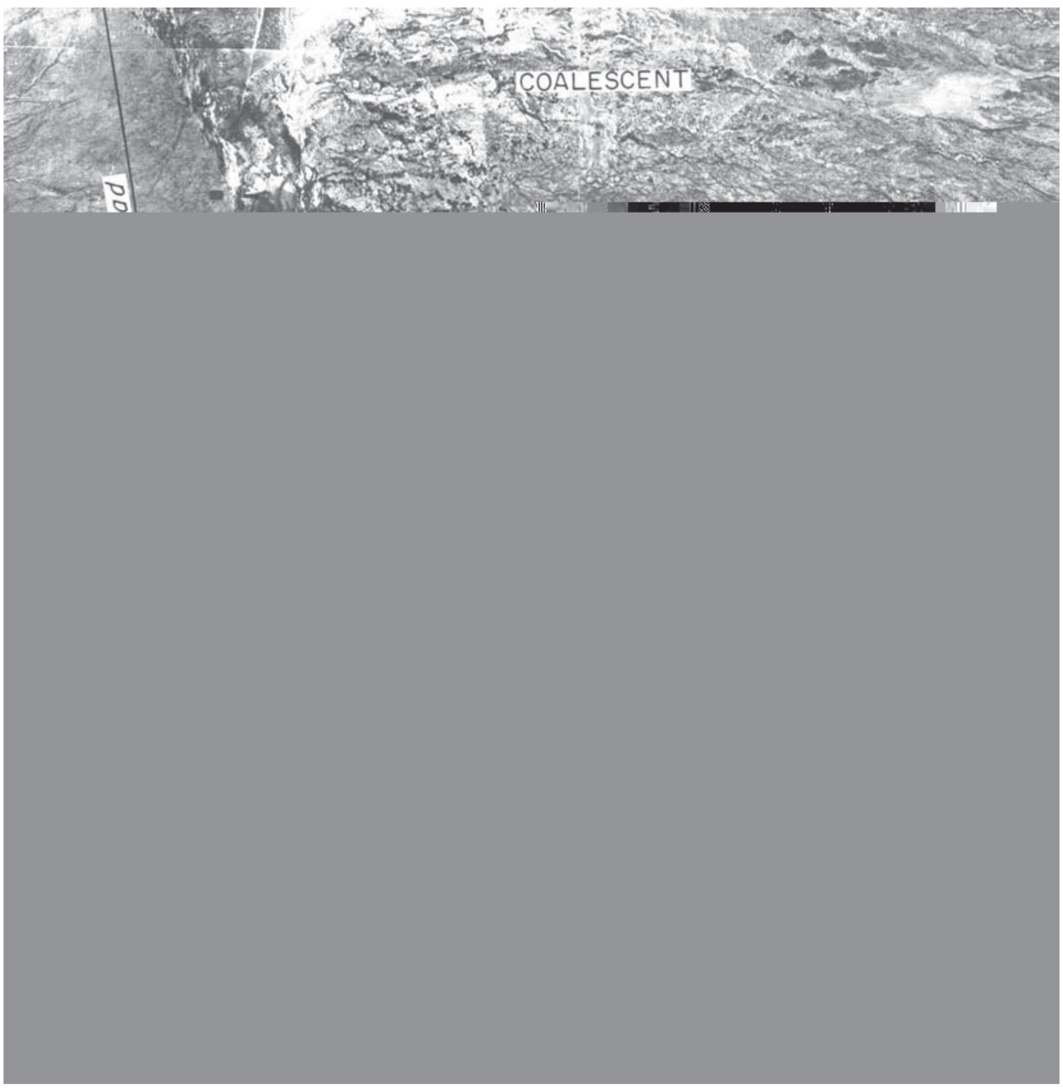

Figure 123.—Location of the Isaacks' radiocarbon site (rectangle in center right; see fig. 124). In contrast to the Gardner Spring radiocarbon site along the mountain front, the Isaacks' radiocarbon site occurs on the fan piedmont. The aerial photograph was taken in 1936.

Figure 124.—Location of charcoal at the Isaacks' radiocarbon site and map of soils in the vicinity. The number 1 shows the location of charcoal dated at 4,035 ± 115 years BP, and 2 shows the location of charcoal dated at 4,200 ± 105 years BP. A gully, which formed along an old road, occurs between the two sites. The soils are identified as follows: A) Onite and Pajarito soils; B) Onite sandy loam; C) Bucklebar, overflow phase; and D) Yucca sandy loam. The north-south road is Moongate Road. The numbers I and II locate the cross section below.

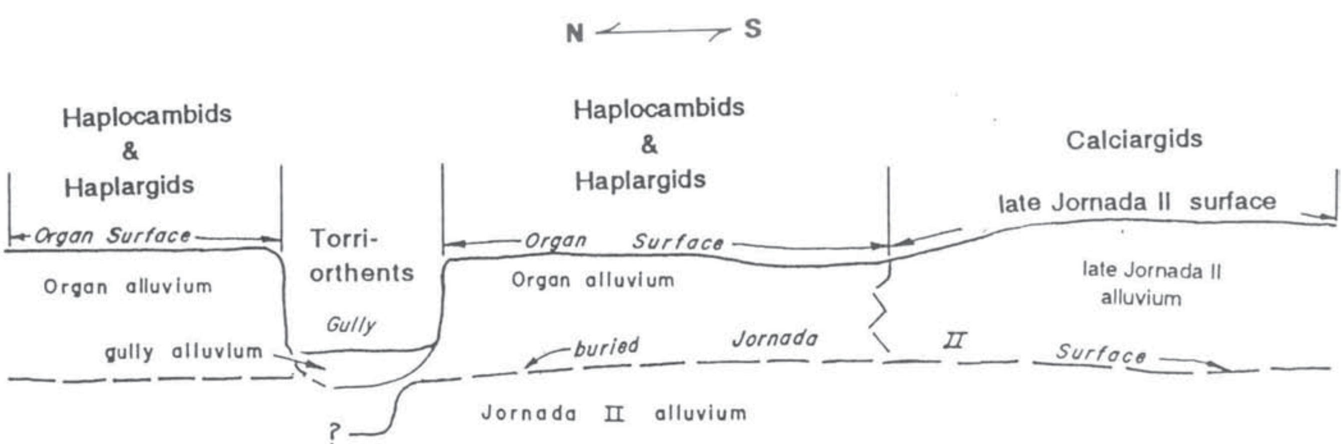

Figure 125.—Cross section from I to II above. Sediments of Organ age are inset against late Jornada II alluvium.

Figure 126.—Landscape view of charcoal horizon 1 (fig. 124) and of the Organ surface and soils, here dominated by the Pajarito and Onite soils, Typic Haplocambids and Haplargids, respectively. The charcoal is located by the hammer, on the edge of a gully at the lower center. Photographed in April 1967.

Figure 127.—A closer view of the charcoal, dated at 4,035 ± 115 years BP, located on the edge of a gully where the upper soil horizons have been truncated by erosion. The charcoal is beneath stage I carbonate occurring as thin, continuous carbonate coatings on sand grains and pebbles.

Figure 128.—Landscape view of charcoal horizon 2 (fig. 124). The San Agustin Mountains are on the skyline. Photographed in October 1967.

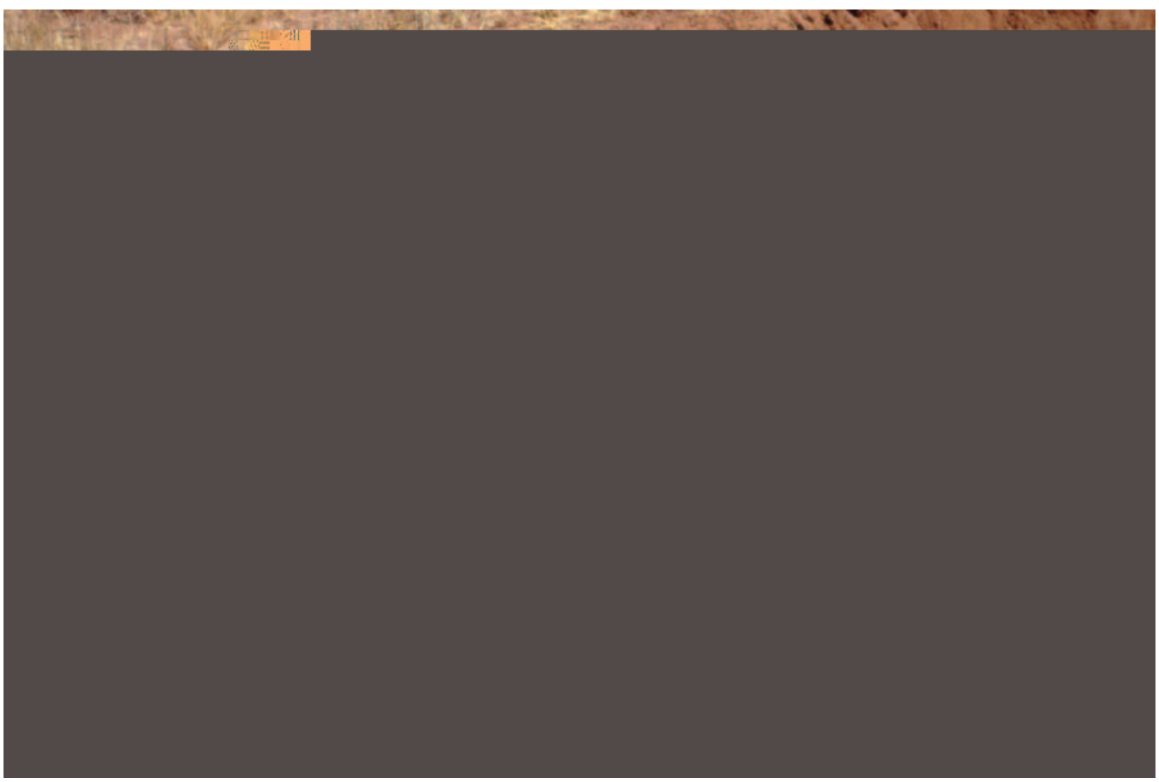

Figure 129.—Buried charcoal dated at 4,200 ± 105 years BP (at right by the jackknife) and the Typic Haplocambid, Pajarito 67-3. A noncalcareous, reddish brown Bt horizon and a stage I carbonate horizon occur above the charcoal and therefore must be less than 4,200 years old. The increase in content of clay in the Bt horizon is not enough for an argillic horizon, and the Bt is a cambic horizon. The scale is in feet.

Figure 130.—Thin section of the Bt horizon in the Typic Haplocambid, Pajarito, at study area 10a. Feldspar grains are dominant, with some quartz, magnetite, and biotite. Argillans are common on sand grains. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

Figure 131.—Thin section of the Ck horizon in the Typic Haplocambid, Pajarito 67-3. Thin stage I carbonate coatings (grain calcitans) occur on many grains. The arrow locates a thin calcitan on the large grain at top. Monzonite is dominant, with some feldspar and quartz and a minor amount of biotite. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

Figure 132.—The Typic Calciargid, Yucca 88-2. Although part of the exposure is in shadow, the argillic and K horizons can be seen at the left of the tape. The vegetation is black grama and snakeweed, both of which are green following rains in July 1988. Photographed in July 1988.

Figure 133.—Thin section of the Bt horizon in the Typic Calciargid, Yucca 88-2. Sample taken from a pit near the description site, in the same soil. Opaque grains are magnetite grains. Magnetite also occurs in the center and lower right. Argillans are prominent on sand grains and are thicker than those of the Haplocambid at area 10a. Crossed polarizers. Bar scale = 100 µm.

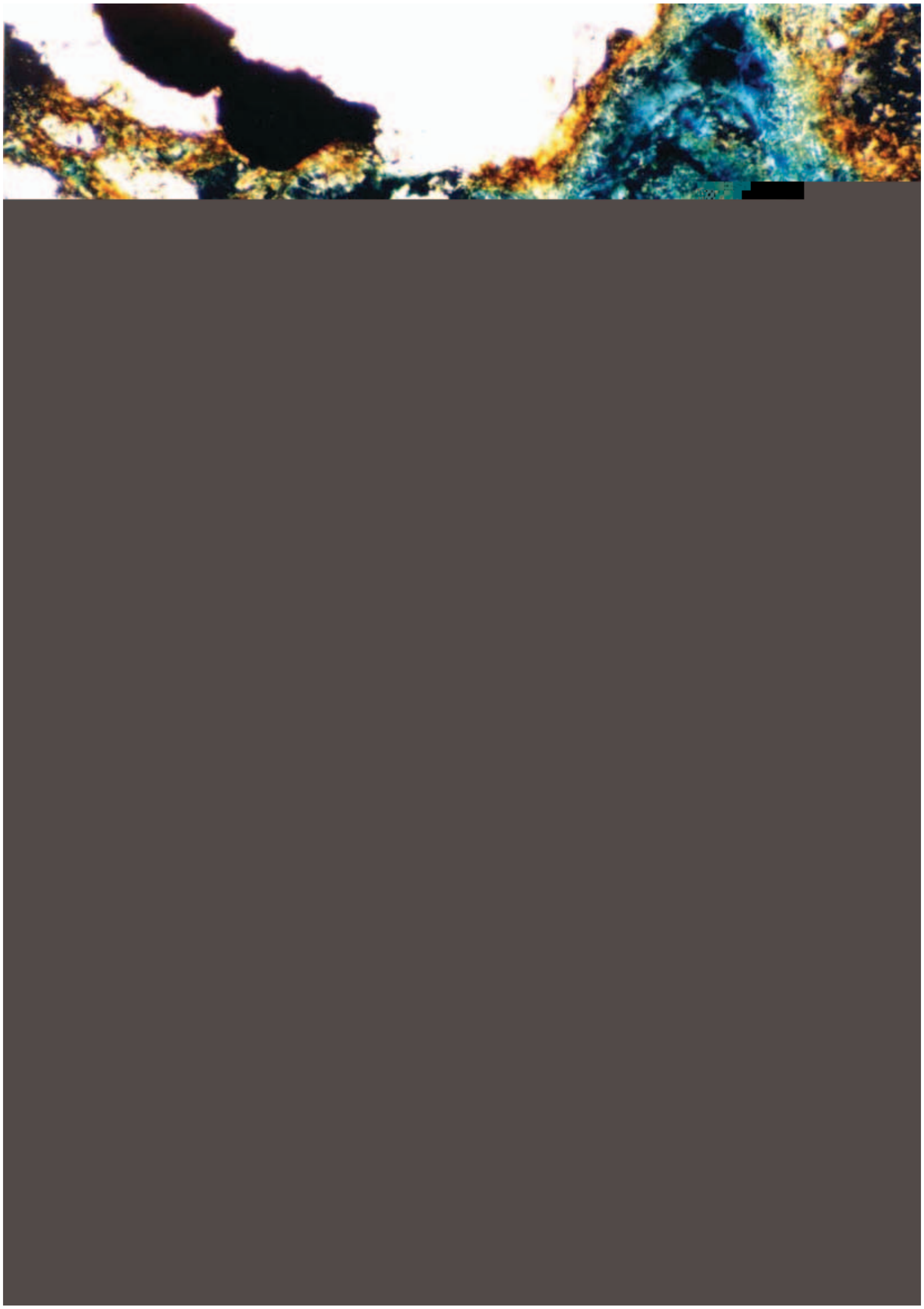

Figure 134.—Thin section of the Btk3 horizon in the Typic Calciargid, Yucca 88-2. Argillans occur on some sand grains, but in the center, parts of the grain argillans have been obliterated by carbonate. Note acicular carbonate (calcified fungal filaments) at lower right. Sand grains are dominantly feldspars. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

The Shalam Colony Radiocarbon Site (High-Carbonate Parent Materials)

Two charcoal horizons have been dated at this site, where the soils have formed in high-carbonate parent materials of the Fillmore surface along the valley border (figs. 135 to 137). Both horizons were revealed in a high cut in Fillmore alluvium (figs. 136 to 139). The upper one, dated at 2,850 years BP, was at a depth of 96 to 104 cm; the lower one, dated at 4,910 years BP, was at a depth of 234 to 242 cm. The upper one is beneath a stage I carbonate horizon with thin carbonate coatings on pebbles, as at Gardner Spring. The high-carbonate parent materials contain abundant fragments of limestone and calcareous sandstone, and no reddish B horizon has formed.

Figure 135.—Location of the Shalam Colony radiocarbon site along the border of the Rio Grande Valley (rectangle at upper right). The Robledo Mountains are dominated by calcareous sedimentary rocks, such as limestone, which provide high-carbonate parent materials for the fans and interfan terraces below.

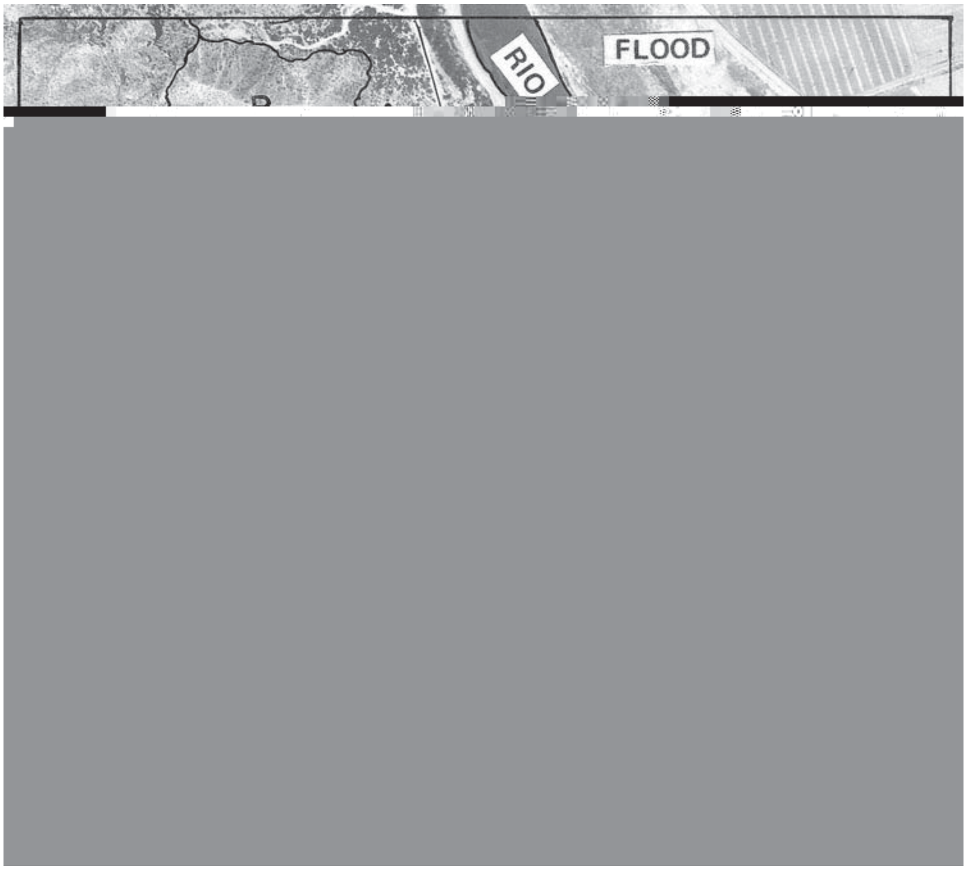

Figure 136.—Location of the Shalam Colony radiocarbon site (no. 2, next to the Rio Grande) and map of soils in the vicinity. The soils are identified as follows: A) Dalian-Torriorthent complex (Fillmore and arroyo channel surfaces); B) Dalian very gravelly sandy loam (Fillmore ridge sides); C) Tencee-Upton complex (Picacho surface); and D) rock outcrop and Torriorthents (mountain slopes and summits, undifferentiated). The numbers I and II locate a cross section from the Picacho surface downward across the Fillmore ridge sides to the Fillmore terrace, on which the radiocarbon site is located.

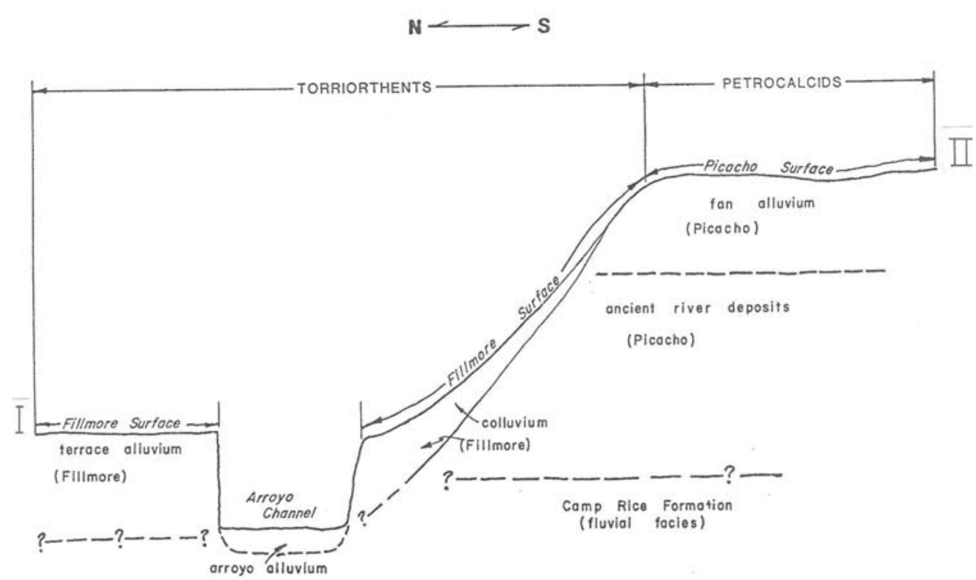

Figure 137.—Cross section of soils, surfaces, and sediments from I to II on the map above.

Figure 138.—Landscape at the Shalam Colony radiocarbon site, where two charcoal horizons have been dated at the cut in Fillmore sediments (most of the cut is in shadow). The Rio Grande (partly obscured by shrubs) is at left. At bottom, Bob Ruhe is changing film in his camera. Photographed in March 1959.

Figure 139.—Buried charcoal dated at 2,850 ± 120 years BP (the dark band to the right of the 3-foot mark) and the Typic Torrifluvent, Anthony. In these high-carbonate parent materials, no reddish brown Bt horizon has formed and the soil is calcareous throughout. Stage I carbonate occurs above the charcoal. A second charcoal horizon, not shown, occurred at a depth of 234 to 242 cm and was dated at 4,910 ± 225 years BP.

The Fillmore Arroyo Radiocarbon Site (Low-Carbonate Parent Materials)

This site is in Fillmore alluvium on the eastern side of the valley border (fig. 140) where the soils have formed in low-carbonate parent materials derived from rhyolite and mixed igneous sediments. The site has one charcoal horizon, dated at 2,620 years BP, at a depth of 112-132 cm in the Typic Torripsamment, Bluepoint 59-17 (figs. 141 to 144).

The zone from 0 to 13 cm is stratified C horizon material. However, there is evidence of pedogenesis beneath, in the form of a noncalcareous B horizon and underlying stage I carbonate horizon with thin carbonate coatings on sand grains, occurring above the dated charcoal.

Although no thin sections are available for this soil, figure 144 is a thin section of the B horizon of University 59-10, a similar pedon. Virtually all of the clay in the horizon occurs as thin coatings of oriented clay on the sand grains, and the same feature is thought to be present in Bluepoint 59-17.

Slumping at the charcoal site revealed a concentration of blackened cobbles and pebbles, in a deposit generally having very few of them (fig. 143). It is probable that the cobbles and pebbles were placed there by humans and that the charcoal came from a hearth site.

Figure 140.—Aerial view of Fillmore Arroyo, at far right. The letter X locates the radiocarbon site with buried charcoal. Tortugas ("A") Mountain is at the center left. The Organ Mountains and the Tularosa Basin are in the background. The view is east. Photographed in November 1958.

Figure 141.—Landscape at the Fillmore Arroyo radiocarbon site (at far left). The Organ Mountains are on the skyline. Bob Grossman is the photographer. Photographed in November 1958.

Figure 142.—Buried charcoal dated at 2,620 ± 200 years BP and the Typic Torripsamment, Bluepoint 59-17. The zone from 0 to 13 cm is young stratified overwash; from 13 to 25 cm the soil is noncalcareous above stage I carbonate consisting of thin coatings on sand grains and pebbles. The scale is in feet.

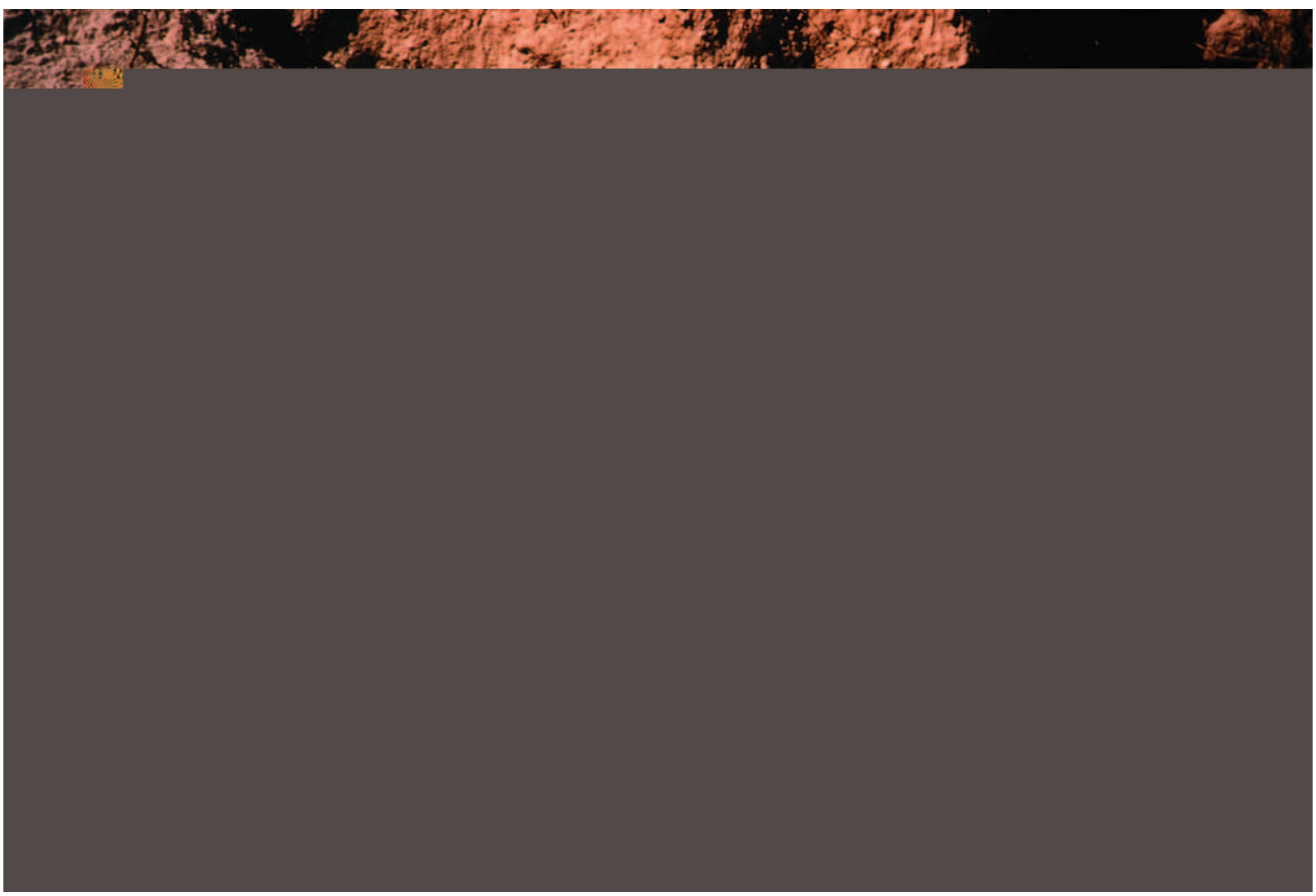

Figure 143.—After the Fillmore Arroyo radiocarbon site was sampled, the soil slumped, revealing charcoal-stained cobbles and pebbles. Fragments of this size are sparse in the deposit, indicating the probability that the charcoal came from an ancient hearth site.

Figure 144.—Thin section of the B horizon in the Typic Torripsamment, University 59-10. Quartz grains are dominant with lesser amounts of feldspar, rhyolite, and magnetite. Thin argillans occur on many sand grains. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 0.5 mm.

Soils of Holocene Scarps in High-Carbonate Materials

High-carbonate alluvium derived from the San Andres Mountains occurs north of alluvium derived from igneous rocks of the San Agustin and Organ Mountains. This change in parent material has caused prominent soil and landscape changes across the boundary between the low- and high-carbonate alluvium on the lower piedmont slope (see figs. 6 and 7 in Gile, 1975a). The landscape changes from generally smooth relief and occasional slight ridges in the low-carbonate alluvium to prominent scarps ranging from a few centimeters to more than $1\frac{1}{2}$ meters in height in the high-carbonate alluvium (figs. 145 and 146). Fine grained Organ alluvium and its soils are exposed in the scarps. Buried soils in Jornada II alluvium occur beneath the Organ alluvium and are commonly at or very near the surface in areas downslope from the scarps.

Figures 145 and 146 show the Ustic Haplocalcid, Reagan 60-14, and its landscape. Reagan 60-14 has a structural B horizon, a filamentary stage I carbonate horizon that qualifies as a calcic horizon, and a buried argillic horizon. The content of clay increases from the A to the B horizon in the land-surface soil, but the oriented clay required for an argillic horizon is not evident (fig 147). The buried Bt horizon of late Pleistocene age, however, does have enough oriented clay for the argillic horizon (fig. 148).

Carbonate in the parent materials tends to flocculate silicate clay and to prevent formation of the oriented clay required an argillic horizon. However, the formation of an argillic horizon does not require that all carbonate be removed. Thin sections (fig. 148) show that the buried argillic horizon still has some limestone pebbles and sand grains. No argillans have formed on the limestone grains, and the grains nearby have no argillans or very weak ones, indicating that limestone grains have a depressing effect on the development of argillans.

Figure 145.—Landscape view of scarps and the Organ surface upslope. The soils are a complex of the Ustic Haplocalcids, Reagan soils, and the Ustic Torrifluvents, Crowflats soils. Below the scarps, buried soils of the Jornada II surface are at or near the surface. The San Andres Mountains are on the skyline. Photographed in February 1980.

Figure 146.— The Ustic Haplocalcid, Reagan 60-14, formed in Organ alluvium. The vegetation is mostly burrograss, with some tobosa and a few tarbush, creosotebush, desert holly, and snakeweed plants. The top of a buried soil in Jornada II alluvium occurs at a depth of about 4 feet. The scale is in feet. Photographed in March 1959.

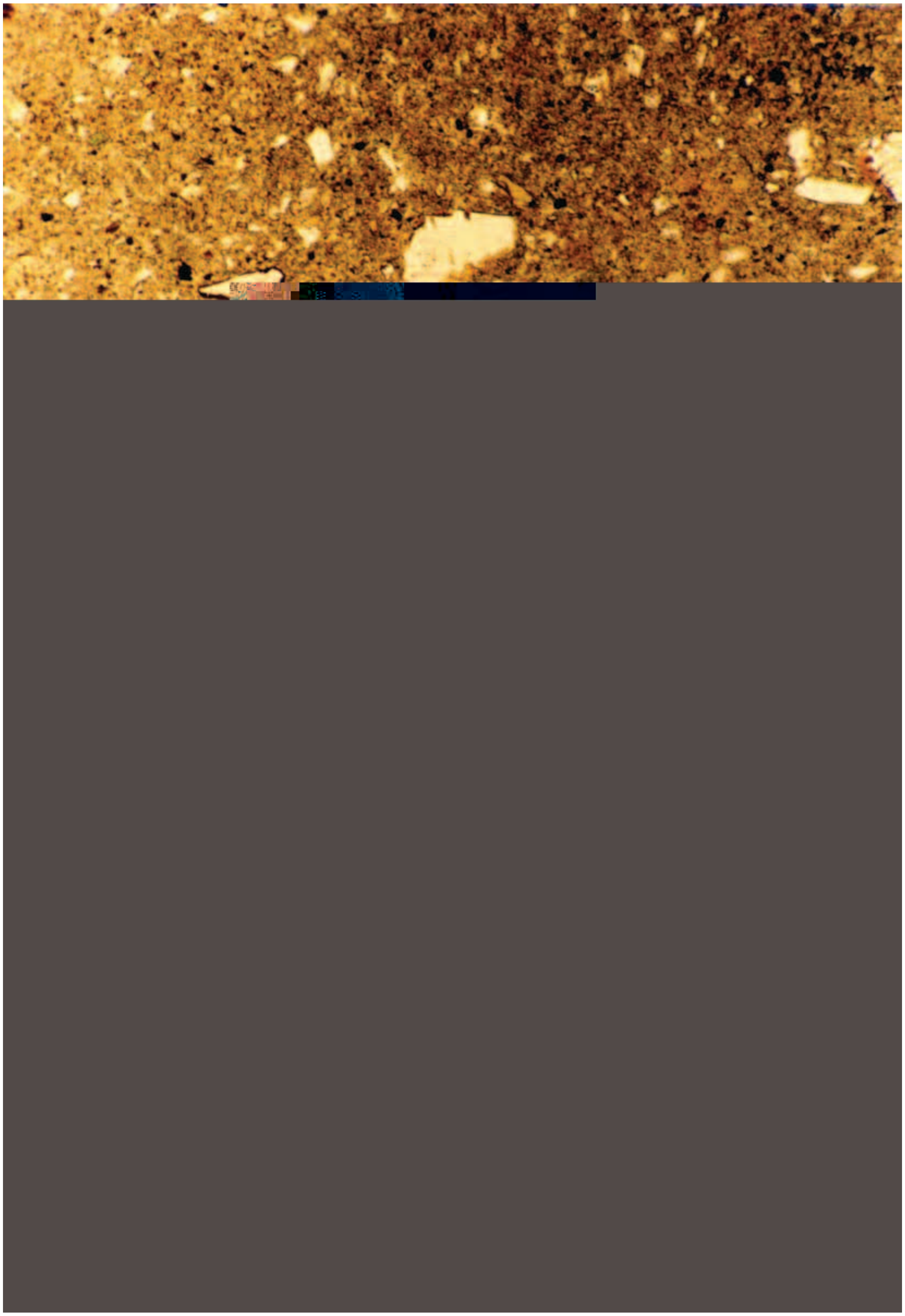

Figure 147.—Thin section of the Bk horizon in the Ustic Haplocalcid, Reagan 60-14. Although the clay content increases from the A to the B horizon, argillans are not evident because there is enough carbonate in the parent materials to prevent their formation. The sands are mostly very fine and are dominantly quartz. *Upper,* plane-polarized light; *lower,* crossed polarizers. Bar scale = 100 µm.

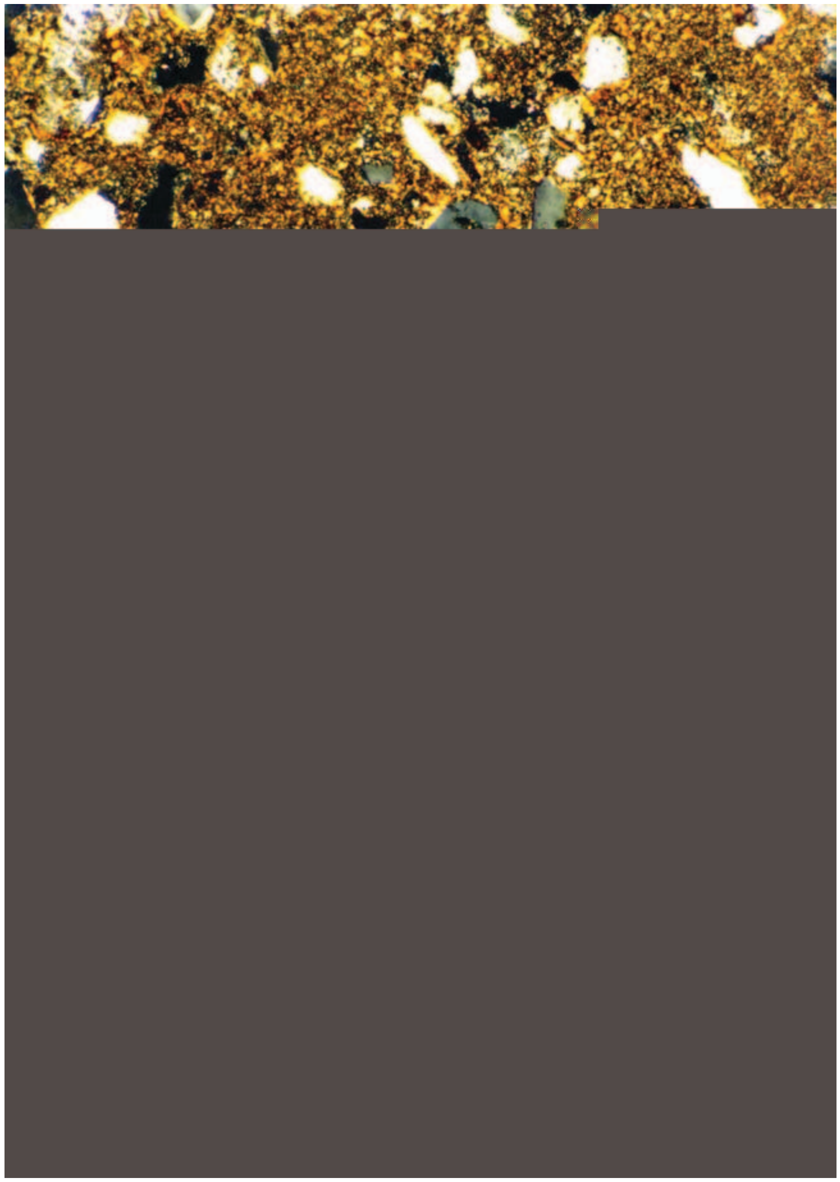

Figure 148.—*Upper:* Thin section of a buried argillic horizon beneath the Ustic Haplocalcid, Reagan 60-14. Feldspars and quartz are dominant. Distinct argillans occur on some grains but on others, argillans have been partly to wholly obliterated by carbonate. Clay along cleavage planes in the large feldspar grain in the center suggests the possibility of weathering, but the grain may have been deposited that way. Crossed polarizers. Bar scale = 100 µm. *Lower:* Another view of the same horizon shows the influence of both primary and pedogenic carbonates on argillan development. No evidence of an argillan can be seen on the large limestone grain (1s) about in the center, and one may never have formed on this carbonate-rich material. The presence of primary carbonate shows that it is not necessary for all of the limestone to be leached out before argillans can form. Argillans are scarcer than in the view above, suggesting that large limestone grains may have a local depressing effect on the formation of argillans. Crossed polarizers. Bar scale = 0.5 mm.

Soil-Geomorphic Reconstruction

In this section we use color maps and illustrations to depict the reconstruction of soils and landscapes of the past. In these reconstructions we show the soil chronology, occurrence of the argillic horizon, and occurrence of the carbonate stages at the end of the Pleistocene full-glacial, 17,000 years ago. We also reconstruct the Jornada I surface (estimated to be 250,000 to 400,000 years old) along part of the valley border. Long exposures of land-surface and buried soils in gullies and in dissected terrains, together with detailed studies in trenches, have been used in the soil-geomorphic reconstructions.

The Soil Chronology 17,000 Years Ago

As shown on the present chronology map (color map 3), extensive areas of late Pleistocene soils and surfaces already exist at the land surface. On the piedmont slope, the reconstruction map has commonly been made by connecting these surficial late Pleistocene soils of Jornada II age with the late Pleistocene soils that have been buried by deposits since the last full-glacial (color map 9). In these places there is generally enough evidence to estimate a dominant late Pleistocene age for those buried soils, indicated on the map by the designation RJ-II, which stands for the reconstructed J-II surface and soils. In other cases, such as near the mountain canyons, there is less certainty about the age of sediments and soils that have been buried by deposits since the full-glacial. Such areas are designated Pleistocene (RP on the reconstruction map).

In some areas of the piedmont slope, there is a complex occurrence of post-full-glacial and older deposits, particularly below the Dona Ana Mountains, where the contributing watershed is relatively small as compared to the San Andres and Organ Mountains. In the present chronology, these complex patterns are indicated by a diagonal pattern below the Dona Ana Mountains.

In contrast to most of the piedmont slope, where soil burial is common, the late and middle Pleistocene surfaces and soils along the valley border have been cut in many places by arroyos that descend to the flood plain along the Rio Grande and erosion surfaces are common. After deposits since the full-glacial have been removed, these areas are designated Pleistocene (RP on the reconstruction map).

In addition to the relatively thick (1 meter to several meters) post-full-glacial deposits shown on the present chronology map, there are also thin (less than $^1/_2$ meter) deposits, not shown, that overlie the older deposits in a number of places. These thin deposits are generally not readily apparent at first glance because of similarities in landscape and soil texture, but they have been observed in detailed studies. Thus, the overall impact of post-full-glacial deposits on soils presently at the land surface has been substantial, and nearly all soils have been affected to some degree. The finer textured soils on the basin floors show little evidence of sedimentation since the full-glacial and probably have been affected least by these younger sediments since that time.

The Argillic Horizon 17,000 Years Ago

The reconstruction map for the argillic horizon (color map 10) shows that the argillic horizon was much more extensive about 17,000 years ago than it is now (compare with the argillic horizon map, color map 6). Burial of soils with argillic horizons by sediments deposited since the full-glacial and carbonate content of the parent materials are major reasons for the difference in area. Argillic horizons have not formed in post-full-glacial sediments that contain only moderate amounts of carbonate. Because more moisture was available for leaching in the Pleistocene pluvials, the argillic horizon could form in sediments with a higher carbonate content than is the case for sediments deposited since the full-glacial. In addition, some argillic horizons have been eroded, mixed by soil biota, and/or engulfed by carbonate accumulation since the end of the full-glacial.

The Stages of Carbonate Accumulation 17,000 Years Ago

Color maps 4 and 11 show the stages of carbonate accumulation at the present time and at the end of the full-glacial (17,000 years ago), respectively. Stage I carbonate and stage II carbonate are virtually absent because they have formed almost exclusively in deposits emplaced since the full-glacial (Organ, Fillmore, Leasburg, and Isaacks' Ranch deposits). In Soledad Canyon of the Organ Mountains, stage I carbonate is common at present in soils of Jornada I age. However, this carbonate must have been emplaced in Holocene time because it is morphologically similar to the carbonate in nearby soils of Holocene age and occurs in similar textures and at similar depths. These Jornada I soils must have been leached free of carbonates in the Pleistocene pluvials (see p. 206-209 in Gile et al., 1981, for further discussion and data).

Constructional Surfaces vs. Structural Benches

The Jornada I geomorphic surface is the oldest and highest of the stepped sequence of surfaces along the valley border (color map 12). Members of the stepped sequence are constructional surfaces formed by the building-up process of sedimentation, followed by a halt in sedimentation, stabilization of the surface, and the beginning of soil formation. In contrast, structural benches are erosional surfaces formed by erosion of materials with little or no gravel and exhumation of the more gravelly underlying materials that constitute the structural bench. The gravelly materials are in river sediments that occur at about the same elevation, hence the occurrence of ridge crests that represent the structural bench at about the same elevation. Picacho has been divided into Late Picacho (15,000-75,000 years BP) and Picacho (75,000-150,000 years BP). See the chronology map.

Reconstruction of the Jornada I Surface

South of Highway 70, the Jornada I surface slopes of Texas. They also occur in the Desert Project (color map 14 and figs. 149 and 150).

No soil horizons have formed in the dunes, which are stratified and fresh-appearing, suggesting that they are young. In land survey notes taken during and after the 1850s, land surveyors indicated the presence of good grass at various section corners. At many of these section corners today, there is no grass and coppice dunes are common. A section corner outlined near the lower left corner of color map 14 is an example. Land survey notes were made there in 1857, 1885, and 1922. On February 9, 1857, a land surveyor wrote the following about this section corner: “Land level sandy plain, some mesquite bushes, grama grass good.” The 1885 notes indicate that the area had changed little by 1885, when grass was present and ranged from poor to good. In the 1922 survey, the area was variously described as rolling or nearly level, with a scattering of mesquite and other shrubs; grass was not mentioned. The occasional mention of rolling topography suggests that the formation of distinct dunes might have started by 1922. The dunes are prominent in aerial photographs taken in 1936 and must have formed primarily between 1885 and 1936.

Buffington and Herbel (1965) found similar conditions in the nearby Jornada Experimental Range (fig. 1):

> Since 1858 the grass cover has decreased tremendously. . . . Vast areas having sandy soil are now dominated by mesquite sand dunes. . . . Livestock are responsible for the dissemination of mesquite seed since the seed is capable of passing through their digestive tracts without being damaged. . . . Seed dispersal, accompanied by heavy grazing and periodic droughts, appeared to be the major factor affecting the rapid increase of shrubs.

The formation of coppice dunes is closely related to the introduction of large numbers of livestock in this general area in the 1880s. The dunes tend to occur primarily in areas where the upper horizons are sand or loamy sand and where there is little or no gravel.

Sheet 4, on the CD that accompanies this publication, shows the actual handwriting in the 1857 survey; a large aerial photograph, taken in 1936, showing the section corner; and a photograph showing dunes at the section corner, taken on March 4, 1998. The dunes and soil horizons shown in figures 149 and 150 are near the section corner shown on sheet 4.

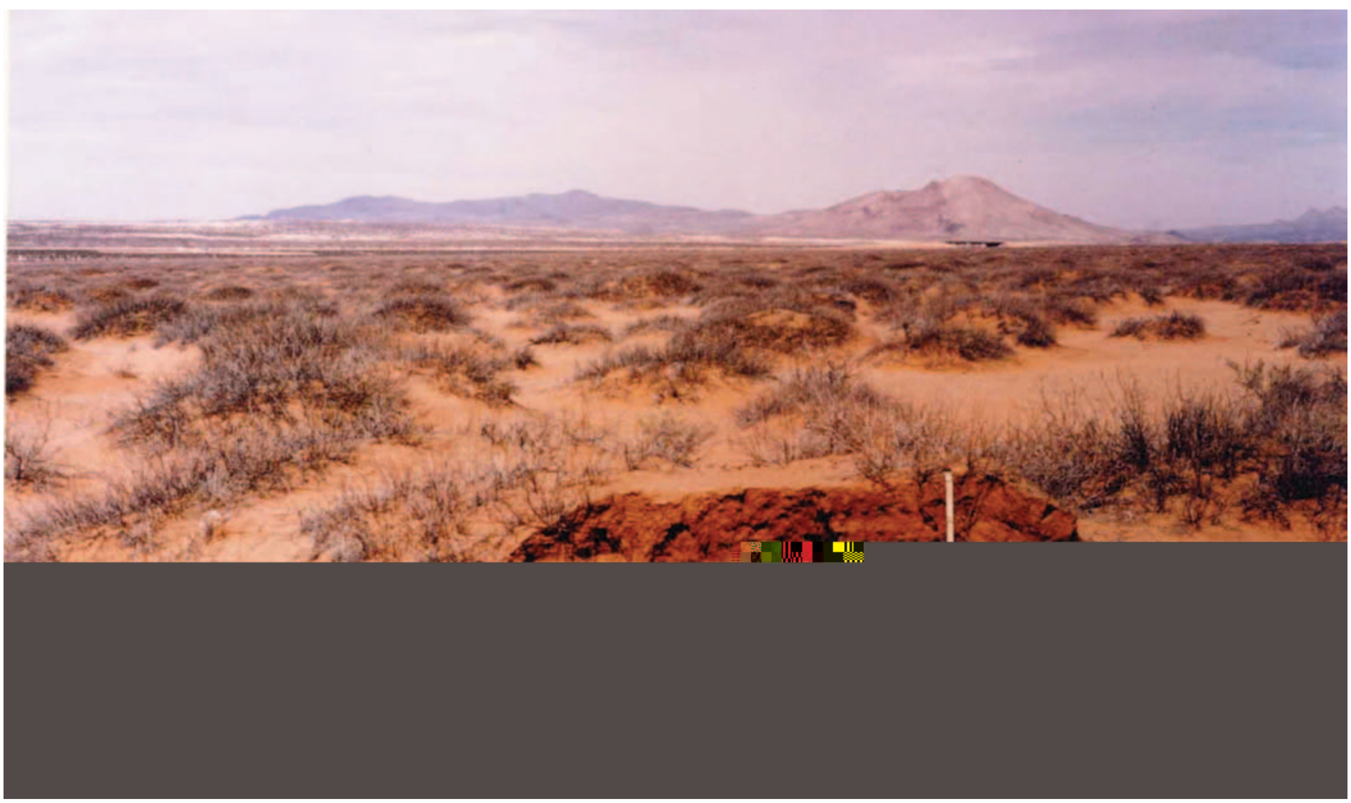

Figure 149.—Landscape of the Typic Torripsamment, Bluepoint, on the lower La Mesa, west of the Rio Grande Valley. Areas between dunes are virtually barren of vegetation, and there is no grass. Scale is in feet. The view is north. Picacho Mountain is the peak at right. The Robledo Mountains are on the skyline at left. Photographed in February 1966.

Figure 150.—A closer view of the Typic Torripsamment, Bluepoint. Young, stratified dune sands extend to a depth of about $4\frac{1}{2}$ feet. The dominant wind movement is from the southwest, left to right. In addition to the change in relief, the expansion of mesquite represents a drastic change from a grass to a shrub type of vegetation that took place in a relatively short time. The wind-blasted face shows distinct layering, especially in the upper part of the soil. The resistant layers mark former crusted surfaces of the dune, which has built upward mainly during spring duststorms. Roots and burrow fillings indicate disturbance and mixing of the sediments. A slight accumulation of windblown sand may have started before 1858. Preserved between the young, stratified sand and the La Mesa Petroargid is a thin deposit, $4\frac{1}{2}$ to 6 feet in depth, that appears to represent an episode of eolian sedimentation that occurred before coppice dunes formed. The deposit has an A horizon and a weak, sandy B horizon that is slightly redder than the A horizon. A long dry period began about 7,000 years ago, and the deposit may have started to accumulate at about that time.

The Detailed Soil Maps

The detailed maps of the study area, included at the back of this publication, were made on 1984 aerial photographs at a scale of 1:15,840. Selected areas mapped at a scale of 1:7,920 were presented in *The Desert Project Soil Monograph* (Gile and Grossman, 1979) and in the Desert Project guidebook and its supplement (Gile et al., 1981 and 1995b).

By convention, the names of map units are kept short. All map units contain more than one soil, and some contain a substantial number of soils. Consult the table of map unit composition to determine the soils that are in a unit instead of going by its name. Some sections in the text are taken from *The Desert Project Soil Monograph* (Gile and Grossman, 1979), with new material introduced at appropriate places. For discussions of special studies in the Desert Project, soil boundaries, soil occurrence, and other soil features, see the soil monograph (Gile and Grossman, 1979).

Map Units and Conventions

There are 82 map units on the soil maps (tables 5 and 6). Most of the units consist of (1) soils belonging to one or more dominant series, phases, taxadjuncts, or analogs (termed “dominant soils”), which are capitalized in the tables of map unit composition, and (2) lesser proportions of other soils (termed “inclusions”), each of which occupy 10 percent or less of the map unit. Percentages of dominant soils are estimated to be within ± 10 percent of the figures given. In instances where proportions of two or more soils in a unit are uncertain, the soils are grouped together and the estimated percentage is given for the group. In some units the presence of extremely small areas of soils is indicated as <$^1/_2$ percent. These small areas are not included in the calculations of soil areas used in the chapter of areal extent of carbon and are included only to alert the user that such soils are part of the unit. A few map units have nearly similar composition but are retained because of differences in soil occurrence, lithology, and/or landscape.

Most map units are named as phases of series, soil complexes, soil associations, consociations, or undifferentiated groups (Soil Survey Division Staff, 1993; tables 5 and 6). Some units that are complexes wholly or in part are not so designated because of name conflicts and are named for the next most appropriate condition. A few units have the names of soils classified above the series level.

Thirty-seven new soil series were established as a result of Desert Project studies (see below). All but three of these (Yturbide, Tonuco, and Kokan) have type localities in or near the Desert Project. The 37 series are as follows:

Aladdin	Cruces	Joveatch	Rotura	Tugas
Algerita	Dalian	Kokan	Santo Tomas	University
Baylor	Hachita	Monterosa	Soledad	Vado
Bucklebar	Hawkeye	Monza	Stellar	Yturbide
Cacique	Hayner	Nolam	Summerford	Yucca
Caliza	Headquarters	Onate	Tencee	
Casito	Herbel	Onite	Terino	
Coxranch	Holliday	Rilloso	Tonuco	

Two soils do not fall within the range of characteristics of established series but are similar to the Dalby and Jai series as follows. The Daiby series is a member of the fine, smectitic, thermic family of Chromic Haplotorrerts. In the study area, a typical pedon (60-16) of the playa soils concerned has mixed mineralogy, and the clay content of the 25- to 100-cm control section averages about 65 percent. The soil is considered to be a taxadjunct to the Dalby series and is classified as a Chromic Haplotorrert, very-fine, mixed, thermic.

The Jal series is a member of the fine-loamy, carbonatic, thermic family of Typic Haplocalcids. Some Haplocalcids have a fine-loamy feel but are actually coarse-loamy. This is the case for many Haplocalcids that have strong carbonate accumulation and developed in materials containing abundant sand, because the carbonate accumulation has diluted the parent materials; when carbonate clay is treated as silt, silicate clay for the 25- to 100-cm control section averages less than 18 percent. Such soils are included in the Jal series in this report.

Soils of the Delnorte, Tonuco, and Simona series are shallow Typic Petrocalcids (table 3). In this study area, they include some soils that are moderately deep instead of shallow to the petrocalcic horizon. Soils of the Terino series, Ustalfic Petrocalcids, have a Bt horizon that is free of carbonates in the upper part. A few soils that have carbonates throughout the Bt horizon are included in the Terino series in this study area.

Few cultural symbols have been used on the soil maps in order to minimize obliteration of landscape patterns shown on the aerial photographs. Roads, pipelines, and power lines are shown because they are important location markers for those who wish to study the soils and landscapes in the field. Section corners plotted on the maps are also useful for location in the field. Pedons analyzed by the NSSL are identified in table 1, and those that are in the Desert Project (some are north of the Desert Project, in the

Table 5.—Acreage and extent of the map units

Map unit name	Map unit symbol	Acres	Percent of total
Most soils classified at series level or lower			
Adelino clay loam	13P	110	0.049
Aladdin analog	13LGO	154	0.069
Algerita complex	16MA	2,699	1.201
Algerita sandy loam	57	730	0.325
Algerita sandy loam, eroded	56	1,187	0.528
Arizo complex	13F	7,058	3.140
Baylor, Santo Tomas, and Earp soils	13RO	1,254	0.558
Berino association	15M	13,378	5.952
Berino-Bluepoint complex	15MB	3,336	1.484
Berino sandy loam	15MA	430	0.191
Bluepoint-Argids complex	13MC	718	0.319
Boracho analog	10LO	374	0.166
Boracho complex	10RO	1,240	0.552
Bucklebar analog, overflow	53A	119	0.053
Bucklebar and Onite soils	14P	954	0.424
Bucklebar complex	13MA	575	0.256
Cacique and Hueco analogs	59	282	0.125
Cacique and Hueco soils and Rotura analog	60	300	0.133
Caliza complex	11X	4,313	1.919
Caralampi complex	12MO	3,427	1.525
Caralampi very gravelly sandy loam	14RO	176	0.078
Cruces soils	12P	3,967	1.765
Dalby clay, overflow	53	134	0.060
Dalian complex	13G	2,967	1.320
Delnorte-Algerita complex	1ORR	6,688	2.975
Delnorte complex	1OR	1,335	0.594
Delnorte very gravelly sandy loam	10OR	172	0.077
Dona Ana-Algerita complex	16M	1,270	0.565
Dona Ana sandy loam	16VG	3,773	1.679
Dona Ana soils	16LS	772	0.343
Eloma complex	12ROA	65	0.029
Glendale-Reagan complex	13L	2,959	1.316
Hachita-Casito complex	12V	2,913	1.296
Hachita-Pinaleno complex	12RR	945	0.420
Hachita and Pinaleno soils	12R	7,429	3.305
Hap gravelly sandy loam	15MG	442	0.197
Hayner complex	12RO	5	0.002
Headquarters complex	16L	7,530	3.350
Herbel and Yturbide soils	13S	123	0.055
Herbel complex	13V	866	0.385
Herbel complex	103ML	1,123	0.500
Herbel soils, Torrifluvents, and Haplocalcids	13LG	3,354	1.492
Herbel soils	13ML	1,404	0.625
Jal sandy loam	11L	1,366	0.608
Kokan complex	1OW	4,612	2.052
Kokan, Yturbide, and University soils	13X	2,004	0.892
Nickel complex	11R	3,385	1.506
Nickel-Delnorte-Simona complex	10V	1,677	0.746
Nickel and Whitlock soils and Argids	11Y	5,380	2.394
Onate complex	13MO	1,807	0.804
Onite and Pajarito soils	13M	1,884	0.838
Onite sandy loam	13MM	3,749	1.668
Onite, Yturbide, and Herbel soils	13MB	1,940	0.863
Reagan clay loam	51	2,319	1.032
Rilloso soils	11A	337	0.150
Rotura-Bluepoint complex	15P	2,836	1.262
Soledad-Onite complex	13R	3,933	1.750
Sonoita, Dona Ana, and Bluepoint soils	15SB	211	0.094
Sonoita, Hueco, and Yucca soils	15SA	239	0.106
Sonoita sand	15S	134	0.060
Stellar-Continental complex	16V	2,136	0.950
Stellar-Continental complex, overflow	55	910	0.405
Summerford complex	13MOA	731	0.325
Summerford soils	14VA	101	0.045

Table 5.—Acreage and extent of the map units—continued

Map unit name	Map unit symbol	Acres	Percent of total
Tencee and Algerita soils	10C	1,518	0.675
Tencee-Calcids complex	10MLO	298	0.133
Tencee-Simona-Cruces complex	10CA	107	0.048
Tencee, Simona, and Cruces soils	58	456	0.203
Tencee soils	100L	826	0.367
Tencee-Upton complex	10L	6,023	2.680
Terino soils	12RA	818	0.364
Terino analogs	123R	904	0.402
Tres Hermanos-Onite complex	14V	686	0.305
University, Bluepoint, and Herbel soils	13YA	101	0.045
University and Bluepoint soils	13Y	29,501	13.125
University-Rilloso complex	11B	81	0.036
Upton-Tencee-Jal complex	10LL	5,357	2.383
Weiser-Dalian complex	11LG	900	0.400
Weiser and Jal analogs	10CB	163	0.073
Whitlock-Berino-Rilloso complex	11YA	578	0.257
Whitlock and Rilloso soils	16MB	870	0.387
Yucca sandy loam	13MD	112	0.050
Soils classified at great group level or higher			
Monzonite rock outcrop, Mollisols and Argids	40M	6,366	2.832
Rhyolite rock outcrop, Mollisols and Argids	40R	11,550	5.139
Sedimentary rock outcrop, Mollisols and Haplocalcids	40L	16,607	7.388
Volcanic rock (undifferentiated) outcrop, Mollisols and Argids	40V	5,158	2.295
Torripsamments, Torriorthents, Haplocalcids and rocky areas	40B	1,052	0.468
TOTAL		224,773	100.0

Table 6.—Map units in numerical order

Map symbol	Map unit name	Map symbol	Map unit name
	Most soils classified at series level or lower		Most soils classified at series level or lower
10C	Tencee and Algerita soils	13MC	Bluepoint-Argids complex
10CA	Tencee-Simona-Cruces complex	13MD	Yucca sandy loam
10CB	Weiser and Jal analogs	13MM	Onite sandy loam
10L	Tencee-Upton complex	13MO	Onite complex
10LL	Upton-Tencee-Jal complex	13MOA	Summerford complex
10LO	Boracho analog	13P	Adelino clay loam
100L	Tencee soils	13R	Soledad-Onite complex
10OR	Delnorte very-gravelly sandy loam	13RO	Baylor, Santo Tomas, and Earp soils
10MLO	Tencee-Calcids complex	13S	Herbel and Yturbide soils
10R	Delnorte complex	13V	Herbel complex
10RO	Boracho complex	13X	Kokan, Yturbide, and University soils
10RR	Delnorte-Algerita complex	13Y	University and Bluepoint soils
10V	Nickel-Delnorte-Simona complex	13YA	University, Bluepoint, and Herbel soils
10W	Kokan complex	14P	Bucklebar and Onite soils
11A	Rilloso soils	14RO	Caralampi very gravelly sandy loam
11B	University-Rilloso complex	14V	Tres Hermanos-Onite complex
11L	Jal sandy loam	14VA	Summerford soils
11LG	Weiser-Dalian complex	15M	Berino association
11R	Nickel complex	15MA	Berino sandy loam
11X	Caliza complex	15MB	Berino-Bluepoint complex
11Y	Nickel and Whitlock soils and Argids	15MG	Hap gravelly sandy loam
11YA	Whitlock-Berino-Rilloso complex	15P	Rotura-Bluepoint complex
12MO	Caralampi complex	15S	Sonoita sand
12P	Cruces soils	15SA	Sonoita, Hueco, and Yucca soils
12R	Hachita and Pinaleno soils	15SB	Sonoita, Dona Ana, and Bluepoint soils
12RA	Terino soils	16L	Headquarters complex
12RO	Hayner complex	16LS	Dona Ana soils
12ROA	Eloma complex	16M	Dona Ana-Algerita complex
12RR	Hachita-Pinaleno complex	16MA	Algerita complex
12V	Hachita-Casito complex	16MB	Whitlock and Rilloso soils
123R	Terino analogs	16V	Stellar-Continental complex
13F	Arizo complex	16VG	Dona Ana sandy loam
13G	Dalian complex	51	Reagan clay loam
13L	Glendale-Reagan complex	53	Dalby clay, overflow
13LG	Herbel soils, Torrifluvents, and Haplocalcids	53A	Bucklebar analog, overflow
13ML	Herbel soils	55	Stellar-Continental complex, overflow
103ML	Herbel complex	56	Algerita sandy loam, eroded
13LGO	Aladdin analog	57	Algerita sandy loam
13M	Onite and Pajarito soils	58	Tencee, Simona, and Cruces soils
13MA	Bucklebar complex	59	Cacique and Hueco analogs
13MB	Onite, Yturbide, and Herbel soils	60	Cacique and Hueco soils and Rotura analog
	Soils classified at great group level or higher		
40B	Torripsamments, Torriorthents, Haplocalcids, and rocky areas		
40L	Sedimentary rock outcrop, Mollisols and Haplocalcids		
40M	Intermediate intrusive rock outcrop, Mollisols and Argids		
40R	Rhyolite rock outcrop, Mollisols and Argids		
40V	Volcanic rock (undifferentiated) outcrop, Mollisols and Argids		

Jornada Experimental Range) are located by a black dot and sample number on the soil maps.

The term “streamwash” designates unstablized areas of sandy and gravelly materials that are flooded and reworked by streams so frequently that they have no pedogenic horizons and little or no vegetation. Streamwash, a miscellaneous area that is similar to riverwash (Soil Survey Division Staff, 1993), is used in this study instead of riverwash because the streams of this study are not rivers. Arroyo channels and associated streamwash commonly show as light colored, narrow, linear patterns on aerial photographs.

Conventional slope classes (Soil Survey Division Staff, 1993) were not used because a system was desired whereby both longitudinal (that is, down an alluvial fan or similarly sloping surface) and transverse (in dissected terrains) slopes could be indicated. Also, in many places one slope (e.g., 2 percent) extends for long distances, and it was desirable to indicate this fact. Slope readings were therefore made directly according to the following system.

In undissected areas that are level or nearly level transversely, slope was shown as:

$$\frac{15M}{2} = \frac{\text{map unit}}{\text{slope}}$$

In dissected areas having a fairly consistent longitudinal slope with a distinct transverse slope, two slope components were noted—the longitudinal slope along the ridge crest and the dominant transverse slope (the slope of ridge sides), as follows:

$$\frac{10RR}{2\text{-}20} = \frac{\text{map unit}}{\text{longitudinal slope-transverse slope}}$$

Dissected areas having a fairly consistent longitudinal slope and a dominantly steep but highly variable transverse slope were designated as:

$$\frac{11Y}{1\text{-d}} = \frac{\text{map unit}}{\begin{array}{l}\text{longitudinal slope-transverse slope}\\ \text{(most slopes range from about 15}\\ \text{ to 40 percent)}\end{array}}$$

Some strongly dissected areas have no consistent longitudinal slope and a transverse slope that is dominantly steep but highly variable. Saddles are common on ridge crests in such areas. These slopes were designated as:

$$\frac{11X}{\text{d}} = \frac{\text{map unit}}{\begin{array}{l}\text{longitudinal slopes along ridge crests}\\ \text{commonly range from about 1 to 10}\\ \text{percent; transverse slopes range}\\ \text{generally from about 15 to 40 percent}\end{array}}$$

The 0 slope designation includes slopes ranging from 0 to $^1/_2$ percent. A map unit designation alone (e.g., 15M) indicates that a slope reading was not taken in the area of the symbol.

Both the size of the map delineations and the number of constituent soils range widely. Some small delineations reflect the desirability of recognizing soils of special significance to understanding soil and landscape evolution. For example, in Ice Canyon in the Organ Mountains there is a remnant of the Dona Ana surface, one of the oldest geomorphic surfaces in the area. The remnant consists of a single small ridge crest. The soil on the ridge crest may have started its development in early Pleistocene or late Pliocene time. The ridge crest appears quite stable. This stability should favor the preservation of soil horizons. The distinctive soils on the ridge crest have been grouped into a single small map unit for which there is only one delineation (map unit 12RO). Such separation recognizes, for the purpose of genetic studies, very small areas of soils which are of little areal importance but of great significance to soil and landscape history. In contrast, delineations are relatively large in areas where the soil patterns are simple and the soils extensive (e.g., unit 13Y). The list of soils in some units is fairly long since an attempt was made to keep track of all soils observed, even though some are of only limited extent.

Relation of Map Unit Symbols to Major Soil Horizons

The map unit symbols on the soil map reflect the degree of development of major soil horizons and the dominant lithology of the soil parent materials (table 7). Thus, the reader can get a general idea about the major features of the dominant soils in an area by determining the map unit symbol of the area and consulting table 7. See sheet 7 (the detailed soil map at a reduced scale at the back of this publication and on the CD that accompanies this publication) for a bird’s-eye view of all soils and map unit symbols.

The two-digit number (three in four cases) that forms the first part of the symbol indicates the degree of development of horizons of carbonate and silicate clay accumulation if they are present. For example, a very important aspect of all map units with symbols beginning with the number 13 is that all of the dominant soils have no horizons of carbonate and clay accumulation or have weakly developed ones. This weak morphology instantly connotes soil age. The

Table 7. —Relation of numbers and letters in map unit symbols to the stage of carbonate accumulation, the argillic horizon, the mollic epipedon and its analog, and the dominant lithology of the parent materials

Number(s) in map unit symbol[1]	Occurrence of carbonate stage, the argillic horizon (A), the cambic horizon (C), in map unit and the mollic epipedon and/or its analog (M) for dominant soils, followed by subgroups and map unit symbols[2]	
		Soils of the valley border and piedmont slopes
10	III, IV, V	Typic and Calcic Petrocalcids: 10C, 10CA, 10L, 10LL, 10R, 10RR, 100R, 100L, 10V
	III, IV, M	Petrocalcic Calciustolls, Calcic Petrocalcids: 10MLO, 10LO, 10RO
11 (10, 16)	III	Typic Haplocalcids: 11A, 11L, 16MA, 16MB, 10CB
	I, III	Typic Haplocalcids, Torriorthents, Torripsamments: 11B, 11X, 10W, 11R, 11LG, 11Y, 11YA
12 (15)	III (plugged), IV, A	Typic Petroargids: 15P
	III, IV, V, A	Argic Petrocalcids: 12P, 12R, 12RR, 12V
	III, IV, A, M	Ustic Haplargids and Calciargids, Ustic Petrocalcids: 12MO, 12RA, 12RO, 12ROA, 123R
13, 103 (14)	I	Typic Torriorthents and Torripsamments: 103ML, 13F, 13G, 13ML, 13S, 13V, 13X, 13Y, 13YA
	I, A	Typic Haplargids: 13M, 13MB, 13MC, 13MM, 13R, 14V
	I, A	Ustic Haplargids: 13MOA, 14VA
	I, A, M	Ustic Haplargids, Aridic Argiustolls and Haplustolls: 13MO, 14RO
	I, M	Pachic Haplustolls: 13LGO
	I, M	Ustic and Typic Haplocalcids and Torrifluvents; 13L
	I, C	Typic Haplocambids: 13P
	II, A	Typic Haplargids: 13MA, 14P
	II, A	Typic Calciargids: 13MD
15 (16)	I, II, A	Typic Haplargids: 15S
	III, A	Typic Calciargids: 15M, 15MA, 15MB, 15MG, 15SB, 16LS, 16M, 16VG
	III, A, M	Ustic Calciargids: 16L, 16V
	I, IV, A	Typic Haplargids, Argic Petrocalcids: 15SA
		Soils of the basin floor north of Highway 70
51	III, M	Ustic Haplocalcids: 51
53	none	Chromic Haplotorrerts: 53
53A	III, A	Ustic Haplargids and Calciargids: 53A
55	III, A, M	Ustic Calciargids: 55
56, 57	III	Typic Haplocalcids: 56, 57
58	V	Typic Petrocalcids: 58
59	III, IV, A, M	Ustalfic Petrocalcids: 59
60	III, IV, A	Argic Petrocalcids: 60

[1] Smaller areas of other units (in parentheses) that have horizons similar to those specified at right are included.

[2] Taxonomic placement of Mollisols is not well related to total organic carbon in Desert Project soils because the upper horizons of some soils have enough organic carbon for a mollic epipedon (diagnostic for the Mollisols) but do not meet the color requirements of darkness and/or chroma. Such horizons are here designated as analogs of mollic epipedons. Soils having a mollic epipedon occur in the semiarid zone along the mountain fronts, and map units there with soils that have a mollic epipedon and/or its analog are designated with the capital letter O (e.g., 13RO). In some map units, capital letters distinguish soils that have some similarities (e.g., units 13MA, 13MB, and 13MC). The carbonate stages can be related to the diagnostic calcic and petrocalcic horizons. All stage III and late stage II horizons qualify as calcic horizons. In high-carbonate parent materials, many stage I horizons qualify as calcic horizons because their parent materials already contained 15 percent or more $CaCO_3$ equivalent, one of the requirements of the calcic horizon in fine-loamy or finer textured materials. All stage V, IV, and plugged stage III horizons qualify as petrocalcic horizons. Map units with soils classified at the great group level or higher are not included in this table.

Dominant lithology of parent materials

The following symbols are used in a very general way to indicate the dominant lithology of the parent materials. Sediments from other rock types commonly are present and in a few places may be dominant.

L, 51: Limestone and other sedimentary rocks, generally with some igneous rocks.

LG: As for L and 51, but some soils have gravelly or very gravelly textures (not used for other rocks).

M: Intermediate intrusive rocks, such as monzonite; in places with rhyolite, andesite, and sedimentary rocks.

ML: Mixture of M and sedimentary rocks.

R, W, F, 11Y, 11YA: Rhyolite; in places with monzonite, andesite, and sedimentary rocks.

S, P, C: Nongravelly, low-carbonate parent materials.

V, 55: Mixed volcanic rocks, such as rhyolite, andesite, and latite, commonly with some intermediate intrusives.

X, 56-60: Gravelly to sandy sediments of the Camp Rice Formation (fluvial facies).

Y: Mostly sandy reworked sediments of the Camp Rice Formation (fluvial facies).

53, 53A: All lithologies.

dominant soils of these units are of middle or late Holocene age, as shown by radiocarbon ages of buried charcoal. Along the valley border, these soils are on the Fillmore geomorphic surface and thus occur on the youngest and lowest terraces that extend upstream from the flood plain of the Rio Grande. Similarly, the number 13 also designates Holocene soils of the Organ surface on the piedmont slope and in the mountain canyons. For soils of the Organ surface, the number 13 also includes the characteristic of sediment thinning downslope. Thus, weakly developed soils that formed in sediments several meters or more thick near the mountain fronts have formed in sediments less than a meter thick at lower elevations, where prominent buried soils that formed largely or wholly in the Pleistocene are very near the surface. Still farther downslope, these buried soils do in fact emerge at the surface as the Organ sediments grade out. Classification of soils involved in this very important geomorphic-soil process of sediment thinning was discussed previously in the section on buried soils.

Map Unit Composition, Symbols, and Names

The following descriptions show the composition of the components of each map unit along with the location, parent materials, landscape, and vegetation of the unit. The descriptions also identify sources of both the organic carbon and carbonate carbon data that were used in chapter 2. The map units are arranged according to their dominant pedogenic development (tables 6 and 7). Table 1 groups the soils by classification, and table 3 lists them alphabetically.

All of the soils are thermic and have mixed mineralogy unless otherwise indicated. All of those with mixed mineralogy are superactive, except for the sandy or sandy-skeletal ones. Abbreviations are used in the column "Soil name and classification" in the following descriptions. The letter *s* means sandy; *c-l*, coarse-loamy; *f-l*, fine-loamy; *f-s*, fine-silty; *f*, fine; *v-f*, very-fine; *s-sk*, sandy skeletal; *l-sk*, loamy-skeletal; *c*, carbonatic; *calc*, calcareous; and *sh*, shallow.

Tencee and Algerita Soils (10C)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	35	Avg. 61-7, 61-8, 66-12, and HCM pedon	62-1
ALGERITA and its disc. cemented analog, c-l Typic Haplocalcids	40	Avg. 61-1 and 61-2	59-10
Simona, l, sh Typic Petrocalcids	10	Same as Tencee	Avg. 59-11, 60-10
Other inclusions:	15		
Bluepoint, Typic Torripsamments		59-17	59-17
Cruces, l, sh Argic Petrocalcids		Avg. 61-7, 66-12	61-7
Hueco, c-l Argic Petrocalcids		Avg. 61-7, 66-12	61-7
Sonoita, c-l Typic Haplargids		72-3	72-3
Tonuco, s, sh Typic Petrocalcids		Avg. 61-7, 66-12	61-7
Simona, eroded, Petrocalcids		Avg. 61-7, 66-12	

Location, Parent Materials, Landscape, and Vegetation

These soils occur along and below scarps cut in the soils of the La Mesa surface south of Picacho and Goat Mountains and north of Fort Selden. The soils have formed in sandy, noncalcareous sediments of the upper Camp Rice Formation. Elevations range from about 4,200 to 4,500 feet.

The soils occur in a digitating pattern between the nearly level basin floor and steeper slopes that descend to the flood plain or to the lower La Mesa. Small arroyos have impinged soils along the scarp, and the resultant landscape consists of discontinuous ridges with the prominent, light-colored K horizon very near and in places at the surface. Slopes along the ridge crests range from 1 to 5 percent. Slopes of ridge sides range from about 10 to 40 percent.

The vegetation consists mainly of scattered creosotebush and, in places, a few ratany plants. Strongly eroded areas, where the petrocalcic horizon is at the surface, are commonly barren of vegetation or have only a very few small creosotebushes. Such areas are extremely arid. The vegetation is thicker in areas around and below edges of the scarps, where creosotebush and tarbush are dominant. Where the petrocalcic horizon has been truncated, dropseed may also occur.

Tencee-Simona-Cruces Complex (10CA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	45	61-7	61-10
SIMONA, l, sh Typic Petrocalcids	35	61-7	60-10
CRUCES, l, sh Argic Petrocalcids	20	61-7	61-7

NOTE: Although not observed, pipes with argillic horizons occur in these basin-floor soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area north of the lower, western part of the Dona Ana Mountains. The soils have formed in sediments of the Camp Rice Formation (fluvial facies). Elevation is about 4,480 feet.

The soils are in an area where La Mesa surface occurs as the level, upthrown floor of the ancient basin. On the basin floor, there are very slight microlows with an amplitude of only a few centimeters, but enough to concentrate water. These slightly lower areas commonly show as dark areas on the soil map because of the increased density of the vegetation.

The shallow petrocalcic horizon, which occurs in all soils of this unit, tends to hold moisture at a shallow depth for plant use, and since the area is level, there is virtually no runoff. Because of these two factors, vegetation is relatively abundant, consisting mainly of bush muhly, fluffgrass, three-awn, snakeweed, creosotebush, mesquite, dropseed, and tarbush.

Weiser and Jal Analogs (10CB)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
WEISER, disc. cemented analog, l-sk, c Typic Haplocalcids	40	65-6	65-6
JAL, disc. cemented analog, C-L, c Typic Haplocalcids	30	65-6	65-6
Outcrops of sediments cemented by carbonate of ground-water origin, alternating with uncemented sediments ranging from sand to clay (miscellaneous area)	30		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in five small areas north and northwest of Goat Mountain. The soils have formed mostly in sediments of the Camp Rice Formation (fluvial facies), in places with some post-Camp Rice sediments derived from the Dona Ana Mountains. Elevation is about 4,300 feet.

The soils occur on ridged terrain formed during valley downcutting and have formed mostly in beds of ground-water type carbonate. These beds commonly consist of indurated beds and nodules that range up to 30 cm or more in diameter. Beds of sandstone occur as ledgy outcrops on slopes, commonly with intervening beds of sediment ranging in texture from the dominant clay and clay loam to sand. Some beds have concentrations of ground-water type carbonate nodules that are not cemented into a continuous bed. The nodular beds weather out on slopes as extremely hard, irregularly shaped nodules.

The vegetation consists of scattered creosotebush, tarbush, *Yucca baccata*, tarbush, *coldenia canescens*, ocotillo, fluffgrass, snakeweed, zinnia, and bush muhly.

Tencee-Upton Complex (10L)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	30	62-1	62-1
UPTON, l, c, sh Calcic Petrocalcids	25	66-5	66-5
Anthony, c-l (calc) Typic Torrifluvents	5	Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Dalian, l-sk, c Typic Torriorthents and its s-sk analog	10	66-4	66-4
Jal, c-l, c Typic Haplocalcids	10	65-6	65-6
Weiser, l-sk, c Typic Haplocalcids	10		
Other inclusions:	10		
Pantera, l-sk (calc) Typic Torrifluvents		65-2	65-2
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Hachita, l-sk, sh Argic Petrocalcids		59-16	59-16
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils occur east and south of the Robledo Mountains and west of the northern part of the Dona Ana Mountains. Most soils have formed in alluvial-fan sediments derived primarily from limestone and calcareous sandstone, in places with some rhyolite. Small areas of sediments near the flood plain contain rounded gravel deposited by the ancestral Rio Grande. Elevations range from about 4,000 to 4,400 feet.

Ridge remnants of alluvial fans are prominent adjacent to the flood plain and extend headward to the mountain margins. The fans have been deeply dissected and the remnants separated from each other by arroyos and low Fillmore terraces. There are a few high remnants of the Tortugas surface as well as the Picacho surface. The Fillmore surface occurs on most ridge sides. In places small areas of the Leasburg surface occur around the margins of the remnants. Some of the remnants are well preserved and are level transversely for substantial distances. Other remnants have been strongly dissected and have prominent narrow ridges. Slopes along the ridge crests range from 3 to 5 percent. Slopes of the steep sides of the remnants range from about 25 to 50 percent and in places are nearly vertical.

The vegetation on the crest of the remnants is mainly creosotebush, with some mesquite. In places there are also scattered tarbush, pricklypear, mariola, and ocotillo. A few clumps of fluffgrass occur in some areas. The steep sides of ridges (which are commonly oriented east-west) show the effects of aspect on vegetation. Commonly, the south-facing slopes have shrubby vegetation, mainly creosotebush (in places with some whitethorn), and barren areas are common on these slopes. Shrubs also grow on the north-facing slopes, but they are generally larger, and perennial grasses are also present—tobosa, bush muhly, and three-awn.

Upton-Tencee-Jal Complex (10LL)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
UPTON, l, c, sh Calcic Petrocalcids	25	66-5	60-20
TENCEE, l-sk, c, sh Calcic Petrocalcids	25	62-1	62-1
JAL, c-l, c Typic Haplocalcids	25	65-6	65-6
Weiser, l-sk, c Typic Haplocalcids	10	65-6	65-6
Anthony, c-l (talc) Typic Torrifluvents	5	Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Dalian, l-sk, c Typic Torriorthents and its s-sk analog	5	66-4	66-4
Other inclusions:	5		
Pantera, l-sk (talc) Typic Torrifluvents		65-2	65-2
Casito, l-sk, sh Argic Petrocalcids		60-1	60-1
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the San Andres Mountains. The soils have formed in alluvium derived mainly from sedimentary rocks, such as limestone, sandstone, siltstone, and shale, in places with smaller amounts of rhyolite, granite, quartzite, and andesite. Elevations range from about 4,500 to 5,000 feet.

The soils occur on individual fans next to the mountain fronts and on the coalescent fan piedmont downslope. Arroyos and gullies are common. Narrow Holocene terraces border the arroyos in some areas. Slopes range from about 5 percent on fans nearest the mountains to 2 percent on the fan piedmont downslope.

The vegetation consists mainly of creosotebush, with a few tarbush, mesquite, and *Yucca baccata* plants.

Boracho Analog (10LO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BORACHO, carb. analog, l-sk, c Petrocalcic Calciustolls	50	62-1	0.86% to 18 cm
KIMBROUGH, l, sh Petrocalcic Calciustolls	40	62-1	0.86% to 18 cm
Next three soils:	10		
Baylor, calc analog, s-sk Torriorthentic Haplustolls		60-19	60-19
Santo Tomas, calc analog, l-sk Pachic Haplustolls		60-19	60-19
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils occur in two small areas along the front of the San Andres Mountains—one west of Bear Canyon and the other west of Hawkeye Canyon. The soils have formed in alluvium derived from limestone, sandstone, siltstone, and shale, in places with smaller amounts of rhyolite, granite, monzonite, quartzite, or andesite. Elevations range from about 4,900 to 5,100 feet.

The soils occur on ridge remnants of Jornada alluvial fans. Small arroyos occur between the larger ridges. Longitudinal slopes along ridge crests range from about 3 to 8 percent; ridge sides slope from about 10 to 25 percent.

The vegetation consists of creosotebush, mariola, *Yucca baccata*, mesquite, snakeweed, and fluffgrass.

Tencee Soils (100L)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	70	62-1	Avg. 62-1 60-20
Upton, l, c, sh Calcic Petrocalcids	10	66-5	60-20
Anthony, c-l (calc) Typic Torrifluvents	5	Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Dalian, l-sk, c Typic Torriorthent and its s-sk analog	5	66-4	66-4
Herbel, c-l (calc) Typic Torriorthents	5	91-11	91-11
Other inclusions:	5		
Pantera, l-sk (calc) Typic Torrifluvents		65-2	65-2
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area along the western front of the San Andres Mountains. This area is west of Bear Canyon. The soils have formed in sediments derived mostly from limestone, sandstone, and shale, commonly with varying amounts of rhyolite, granite, and quartzite. Elevations range from about 4,700 to 4,900 feet.

Ridge remnants of a large alluvial fan are the major landscape features. Ridge crests are Jornada I, and ridge sides are Jornada II. Small valley fills of Organ age, commonly cut by gullies, occur at the base of ridge sides. Longitudinal slopes along ridge crests range from 3 to 5 percent. Slopes of ridge sides range from 5 to 20 percent.

The vegetation consists of creosotebush, fluffgrass, mesquite, zinnia, bush muhly, and mariola.

Delnorte Very Gravelly Sandy Loam (100R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DELNORTE, l-sk, sh Typic Petrocalcids	85	Avg. 61-10, 66-2	Same as $CaC0_3$
Simona, l, sh Typic Petrocalcids	10	Avg. 59-11, 60-10	Same as $CaC0_3$
Hachita, l-sk, sh Argic Petrocalcids	5	59-16	59-16

Location, Parent Materials, Landscape, and Vegetation

These soils occur in six small areas west of the central and northern parts of the Organ Mountains and in three small areas west of the rhyolite parts of Quartzite Mountain. West of the Organ Mountains, the soils have formed in alluvium that generally is dominated by rhyolite and monzonite sediments, except for the northernmost of the six areas, where the soils have formed mostly in monzonite sediments. A minor amount of limestone sediments occurs in places. Elevations range from about 4,800 to 5,000 feet.

These soils occur on isolated ridge remnants of alluvial fans of Jornada age or older. Most of the ridges are isolated by younger terraces inset against them. Slopes along the ridges range from about 3 to 15 percent. Slopes of ridge sides range from 10 to 25 percent.

The vegetation is mostly creosotebush, with a few pricklypears and with fluffgrass, *Yucca baccata*, ratany, tarbush, and snakeweed in places.

Tencee-Calcids Complex (10MLO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	60	66-2	0.79% to 18 cm (SA22)
Skeletal Calcids	25	66-5	0.79% to 18 cm (SA22)
Inclusions:	15		
Bodecker, s-sk Ustic Torriorthents		Avg. 60-3, 66-3	Same as $CaC0_3$
Streamwash (miscellaneous area)			
Terino, l-sk Ustalfic Petrocalcids		70-8	70-8

Location, Parent Materials, Landscape, and Vegetation

These soils occur in two areas west of the central part of the Organ Mountains. The soils have formed in alluvium derived mostly from monzonite but commonly with some limestone, andesite, and rhyolite. Elevations range from 5,000 to 6,200 feet.

These soils occur on isolated remnants of fans that are mostly of Jornada age. Slopes along the ridge crests range from 5 to 12 percent; slopes along ridge sides range from 5 to 25 percent.

The vegetation consists mostly of creosotebush, tarbush, fluffgrass, pricklypear, snakeweed, *Yucca baccata*, mesquite, bush muhly, and buckwheat. At the higher elevations, black grama, sideoats grama, and ocotillo also occur.

Delnorte Complex (10R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DELNORTE, l-sk, sh Typic Petrocalcids	40	Avg. 61-10, 66-2	Avg. 61-10, 66-2, + 0.45% to 18 cm, 67-2*
Next two soils:	40		
NICKEL, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
SIMONA, l, sh Typic Petrocalcids		Avg. 59-11, 60-10	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents	10	Avg. 60-3, 66-3	Same as $CaC0_3$
Whitlock, c-l Typic Haplocalcids	5	60-2	60-2
Other inclusions:	5		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Dona Ana, f-l Typic Calciargids		61-4	61-4
Hachita, l-sk, sh Argic Petrocalcids		59-16	59-16
Streamwash (miscellaneous area)			

* Convention—extend to top of Km.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in scattered small areas along the valley border. They have formed in sediments derived primarily from rhyolite. In places there are a few andesite fragments and rounded pebbles of quartz and chert. Elevations range from about 4,200 to 4,400 feet.

Most of the soils are on terraces and isolated ridge remnants of the Picacho surface. Longitudinal slopes along ridge crests are about 2 percent; ridge sides slope from 10 to 35 percent. Commonly, small drainageways occur on the ridge remnants and fans.

The vegetation is mostly creosotebush and ratany; in places there are scattered mesquite and pricklypear.

Boracho Complex (10RO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BORACHO, l-sk, sh Petrocalcic Calciustolls	30	70-8	0.86% to 18 cm
Next three soils:	30		
Monterosa, l-sk, sh Ustic Petrocalcids		66-2	0.72% to 18 cm
Nolam, mollic analog, l-sk Aridic Argiustolls		60-2	0.86% to 18 cm
Terino, l-sk, sh, Ustalfic Petrocalcids		70-8	0.86% to 18 cm
Hathaway, l-sk Aridic Calciustolls	5	Avg. 59-13, 60-2, 60-11	0.86% to 18 cm
Polar, l-sk Ustic Haplocalcids	5	Avg. 59-13, 60-2, 60-11	0.72% to 18 cm
Santo Tomas, l-sk Pachic Haplustolls	5	60-12	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Mierhill, l-sk, sh Petrocalcic Paleustolls	5	70-8	0.86% to 18 cm
Other inclusions:	15		
Bodecker, s-sk Ustic Torriorthents		59-3	59-3
Holliday, l-sk Ustic Haplargids		---	Avg. sites 2-4, OMF
Kimbrough, l, sh Petrocalcic Calciustolls		66-2	0.86% to 18 cm
Monterosa, mod. deep analog l-sk Ustic Petrocalcids		66-2	0.72% to 18 cm

Location, Parent Materials, Landscape, and Vegetation

These soils occur on high remnants of alluvial fan remnants west of the central part of the Organ Mountains. The soils have formed in sediments derived from rhyolite. Elevations range from about 4,800 to 5,300 feet.

Much of the area has been deeply dissected by arroyos. High, narrow ridges are typical; ridge crests are Dona Ana surface, and ridge sides are Jornada. Longitudinal slopes along ridge crests range from about 10 percent next to the mountains to 4 percent in the western part of the unit. Slopes of ridge sides range from about 15 to 40 percent; they most commonly range from 25 to 30 percent.

The prominent east-west ridges with their north- and south-facing slopes have an effect on vegetation.

Perennial grasses are more common on the north-facing slopes, and the type of shrub is also affected. On the several prominent east-west ridges in the northernmost delineation of this map unit, for example, north-facing slopes (of 25 to 30 percent) typically have common black grama, fluffgrass, ratany, mariola, cholla, pricklypear, Mormon tea, *Yucca baccata*, large sumacs, and only a few creosotebushes. South-facing slopes, in contrast, are more sparsely vegetated and most of the vegetation consists of shrubs. The vegetation at various places consists mainly of ratany, pricklypear, fluffgrass, creosotebush, *Yucca baccata*, ocotillo, and whitethorn.

Delnorte-Algerita Complex (10RR)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DELNORTE, l-sk, sh Typic Petrocalcids	40	Avg. 60-10, 66-2	Same as $CaC0_3$
ALGERITA, c-l Typic Haplocalcids	25	60-6	60-10
Nickel, l-sk Typic Haplocalcids	10	59-13, 60-2, 60-11	Same as $CaC0_3$
Simona, l, sh Typic Petrocalcids	10	Avg. 59-11, 60-10	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Other inclusions:	10		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents		Avg. 60-3, 66-3	Same as $CaC0_3$
Hachita, l-sk, sh Argic Petrocalcids		51-11	51-16
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

Location, Parent Materials, Landscape, and Vegetation

These soils occur east of the valley border in a broad, north-south belt west of the southern part of the Organ Mountains. The soils have formed in sediments derived mainly from rhyolite, with smaller amounts of andesite and monzonite in the northern part of the unit. Elevations range from about 4,350 to 4,800 feet.

Long, east-west ridges (Jornada I remnants) are prominent in this map unit. Ridge crests are narrow; parts that are level transversely range from about 1 to 10 meters in width. Longitudinal slopes along ridge crests range from about 3 percent nearest the mountains to 2 percent in the western part of the unit. Slopes of ridge sides range from about 5 to 35 percent. Small drainageways extend down ridge sides to arroyos or to adjacent, lower surfaces.

The Jornada I ridges, which are the topographic highs in this map unit, are separated from each other by arroyo channels and by younger, lower surfaces. Small areas of the Tortugas surface, occurring as short (a few meters), rounded remnants abut the slightly higher Jornada I. The Picacho surface occurs primarily as narrow, discontinuous terraces that border arroyos and are inset against the higher Jornada I and Tortugas surfaces.

Commonly, these terraces have not been greatly dissected and are level or nearly level transversely. The Fillmore, the lowest surface and generally about 1 meter or less higher than the arroyo channels, occurs as isolated remnants and as low terraces inset against sediments beneath the older surfaces. Along the eastern border of the unit, sediments of the Organ surface in places overlie or are inset against the Jornada I ridges.

Creosotebush and ratany are dominant. Whitethorn and pricklypear are common in some areas and in places—particularly at the higher elevations—there are also scattered snakeweed, tarbush, ocotillo, soaptree yucca, Mormon tea, and bush muhly.

Nickel-Delnorte-Simona Complex (10V)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First three soils:	80		
NICKEL, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
DELNORTE, l-sk, sh Typic Petrocalcids		Avg. 60-10, 66-2	Same as $CaC0_3$
SIMONA, l, sh Typic Petrocalcids		Avg. 59-11, 60-10	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Hachita, l-sk, sh Argic Petrocalcids	5	59-16	59-16
Other inclusions:	10		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

Location, Parent Materials, Landscape, and Vegetation

These soils border parts of the Dona Ana Mountains. The soils have formed in sediments derived primarily from andesite, monzonite, and rhyolite. Elevations range from about 4,300 to 4,800 feet.

Most areas have been dissected by arroyos. Jornada ridges are the dominant landscape feature. Longitudinal slopes along ridge crests range from about 3 to 7 percent; slopes of ridge sides range from 10 to 35 percent.

The vegetation is mostly creosotebush with scattered mesquite, tarbush, zinnia, *Yucca baccata*, bush muhly, and pricklypear.

Kokan Complex (10W)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First four soils:	60		
CALIZA, s-sk Typic Haplocalcids		Avg. 59-13, 60-11	59-13
RILLOSO, s Typic Haplocalcids		60-11	60-11
KOKAN, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
YTURBIDE, Typic Torripsamments		Avg. 60-3, 61-6	Same as $CaC0_3$
Streamwash (miscellaneous area)	10		
Canutio, l-sk (calc) Typic Torriorthents	5	Avg. 60-3, 66-3	
Herbel, c-l (calc) Typic Torriorthents	5	91-11	
Delnorte, l-sh, sh Typic Petrocalcids	5	Avg. 61-10, 66-2	Same as $CaC0_3$
Other inclusions:	15		
Bluepoint, Typic Torripsamments		59-17	59-17
Haplargids		Avg. 88-2, 60-7	Same as $CaC0_3$
Whitlock, c-l Typic Haplocalcids		60-2	60-2

Location, Parent Materials, Landscape, and Vegetation

These soils occur primarily on the eastern side of the valley border, west of the Dona Ana Mountains, with smaller areas in the southern part of the study area. The soils have formed in alluvial-fan sediments derived mainly from rhyolite, in places with andesite, monzonite, and rounded gravel of mixed lithology. Elevations range from about 4,000 to 4,400 feet.

Most areas have been strongly dissected by arroyos; long, narrow ridges are prominent. Narrow terraces are inset against some of the ridge remnants. Waterways and gullies extend laterally from the arroyos and have incised the ridges in places. In some areas arroyo dissection has been so severe that the original depositional slope has been substantially altered even on ridge crests. Saddles are common in such areas. Longitudinal slopes along ridge crests range from 2 to 5 percent; transverse slopes of ridge sides range from 5 to 35 percent.

The vegetation is primarily creosotebush; there are a few pricklypear and mesquite plants.

Rilloso Soils (11A)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
RILLOSO, s Typic Haplocalcids	65	60-11	60-2
Yturbide, Typic Torripsamments	10	60-3, 61-6	61-6
University, Typic Torripsamments	10	Avg. 59-10, 93-1, and 93-2	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents	5	Avg. 60-3, 61-6	Same as $CaC0_3$
Other inclusions:	10		
Simona, 1 Typic Petrocalcids		Avg. 59-11, 60-10	
Sonoita, c-l Typic Haplargids*		92-3	92-3
Streamwash (miscellaneous area)			

* In this map unit, includes soils as thin as 2 feet (60 cm) over buried calcic horizons.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in three areas north of Fort Selden. The soils have formed in sandy sediments derived from the Camp Rice Formation (fluvial facies). Elevations range from 4,100 to 4,300 feet.

Most soils occur on ridge remnants of Picacho fans sloping about 3 to 4 percent to the south. Small arroyos extend into the remnants in places.

The vegetation consists of dropseed, mesquite, snakeweed, creosotebush, bush muhly, zinnia, and fluffgrass.

University-Rilloso Complex (11B)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
UNIVERSITY, Typic Torripsamments	60	Avg. 59-10, 93-1, and 93-2	Same as $CaC0_3$
RILLOSO, s Typic Haplocalcids	30	60-11	60-2
Inclusions:	10		
Sonoita, sandy analog, s Typic Haplargids		59-10	59-10
Tonuco, s, sh Typic Petrocalcids		61-7	59-10 to 50 cm
Yucca, c-l Typic Calciargids		90-1	90-1

Location, Parent Materials, Landscape, and Vegetation

These soils occur in two areas north of Fort Selden. The soils have formed in sandy sediments derived from the Camp Rice Formation (fluvial facies). Elevations range from 4,100 to 4,300 feet.

The soils occur on ridges that slope 3 to 4 percent to the southwest. Coppice dunes are common. Minor drainageways extend into the ridges.

The vegetation consists of dropseed, Mormon tea, mesquite, four-wing saltbush, soaptree yucca, and snakeweed.

Jal Sandy Loam (11L)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
JAL, f-l, c Typic Haplocalcids	75	65-6	65-6
Upton, l, sh Calcic Petrocalcids	10	66-5	Avg. 66-5, 60-20
Dona Ana, f-l Typic Calciargids	5	65-5	65-5
Tencee, l-sk, c, sh Calcic Petrocalcids	5	62-1	Avg. 62-1, 60-20
Other inclusions:	5		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Dalian, l-sk, c Typic Torriorthents		66-4	66-4

Location, Parent Materials, Landscape, and Vegetation

These soils occur mainly west of the San Andres Mountains. In some small areas they are near the Dona Ana and Tortugas Mountains. The soils have formed in alluvium derived mainly from limestone, sandstone, siltstone, and shale. In places there are smaller amounts of granite, quartzite, andesite, and rhyolite in the alluvium. Elevations range from about 4,400 to 4,550 feet.

There are a few gently sloping drainageways ranging from 1 to several meters in width. There are several very slight ridges. In some areas small drainageways, 1 to several decimeters in height, occur between shrubs. A few centimeters of sandy sediments have accumulated around some of the shrubs. There are no large arroyos, but there are a few gullies. Most slopes range from 1 to 2 percent; a few range to 25 percent.

The vegetation is dominantly creosotebush, with a few mesquite and tarbush plants; in places there are a few clumps of tobosa and burrograss.

Weiser-Dalian Complex (11LG)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
WEISER, l-sk, c Typic Haplocalcids	30	65-6	Avg. 65-6, 59-13
DALIAN, l-sk, c Typic Torriorthents	25	66-4	66-4
JAL, f-l, c Typic Haplocalcids	15	65-6	65-6
Dalian, s-sk analog, s-sk, c Typic Torriorthents	10	66-4	66-4
Herbel, c-l (calc) Typic Torriorthents	10	91-11	91-11
Shallow Petrocalcids	5	Avg. 66-2, 59-11, 60-10	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in scattered small areas west of the Dona Ana Mountains and east and south of the Robledo Mountains. The soils have formed in sediments derived primarily from limestone and calcareous sandstone, in places with smaller amounts of shale and igneous rocks, such as rhyolite. Elevations range from about 4,000 to 4,400 feet.

Ridges are prominent; the sediments have been strongly dissected by arroyos. Side waterways and gullies extend laterally from arroyos and have incised the ridges. Slopes along ridge crests range from about 2 to 5 percent; slopes of ridge sides range from 5 to 50 percent.

The vegetation consists mostly of creosotebush, in places with mesquite, pricklypear, and whitethorn.

Nickel Complex (11R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First four soils:	60		
NICKEL, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
WHITLOCK, c-l Typic Haplocalcids		60-2	60-2
CALIZA, s-sk Typic Haplocalcids		59-13	59-13
RILLOSO, s Typic Haplocalcids		60-11	Avg. 60-2, 60-11
Streamwash (miscellaneous area)	10		
Yturbide, Typic Torripsamments	10	Avg. 60-3, 61-6	61-6
Kokan, s-sk Typic Torriorthents	5	Avg. 60-3, 61-6	Same as $CaC0_3$
Other inclusions:	15		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Delnorte, l-sk, sh Typic Petrocalcids		Avg. 60-10, 66-2	Same as $CaC0_3$
Dona Ana, f-l Typic Calciargids		61-4	61-4
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Yucca, c-l Typic Calciargids	$<^1/_2$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur on the eastern side of the valley border, primarily west of the Dona Ana Mountains. There are also several delineations in the southern part of the study area. The soils have formed in alluvium that is derived primarily from rhyolite but that in places has andesite and rounded chert and quartz. Elevations range from about 4,100 to 4,500 feet.

These soils occur on ridge remnants of alluvial fans. Ridge crests are of Picacho age; ridge sides are Fillmore. Most ridges show distinct evidence of truncation in the form of small waterways leading to ridge crests. However, some ridges have not been prominently rounded by erosion. These represent the stablest parts of the Picacho surface bordering the flood plain. Slopes along ridge crests range from 2 to 3 percent. Slopes of ridge sides range from about 10 to 50 percent.

The vegetation consists primarily of creosotebush; there are a few mesquite, ratany, and pricklypear plants.

Caliza Complex (11X)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CALIZA, s-sk Typic Haplocalcids	25	Avg. 59-13, 60-11	59-13
Next four soils:	60		
KOKAN, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
UNIVERSITY, Typic Torripsamments		59-10	59-10
YTURBIDE, Typic Torripsamments		60-3, 61-6	61-6
RILLOSO, s Typic Haplocalcids		60-11	Avg. 60-2, 60-11
Streamwash (miscellaneous area)	10		
Next two soils:	5		
Arizo, s-sk Typic Torriorthents			
Delnorte, l-sk, sh Typic Petrocalcids		Avg. 60-10, 66-2	Avg. 61-10, 66-2, 0.45% to 18 cm
Nickel, l-sk Typic Haplocalcids	$<\frac{1}{2}$		
Whitlock, c-l Typic Haplocalcids	$<\frac{1}{2}$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur mainly on the eastern side of the valley border, in the southern part of the study area. The soils have formed in sand and rounded gravel of the Camp Rice Formation (fluvial facies), which occurs both in-place and reworked as sideslope colluvium and as young alluvial deposits between the ridges. Elevations range from about 4,200 to 4,300 feet.

High ridges of a structural bench are prominent landscape features. The sediments have been cut by arroyos. Side drainageways extend from arroyos and sharply incise the ridges, forming saddles. Ridge crests are generally narrow and rounded, but some are level transversely for a few feet. The highest ridges are at about the same elevation. Slopes along ridge crests range from 1 to 5 percent. Ridge sides slope from 5 to 35 percent.

The vegetation on ridge crests generally consists of ratany, fluffgrass, and scattered creosotebush and pricklypear. South-facing slopes tend to have less vegetation, which is mainly ratany and creosotebush. In places there are clumps of fluffgrass and three-awn, especially in or near drainageways. North-facing slopes have more vegetation and larger shrubs, consisting of Mormon tea, ratany, a few creosotebushes, and common fluffgrass. Quite large clumps of three-awn and black grama occur in places, particularly on the lower slopes and in drainageways.

Nickel and Whitlock Soils and Argids (11Y)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
NICKEL, l-sk Typic Haplocalcids*	30	Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Next two soils:	30		
WHITLOCK, c-l Typic Haplocalcids*		60-2	60-2
ALGERITA, c-l Typic Haplocalcids*		60-6	60-6
Next four soils:	20		
Berino, f-l Typic Calciargids		Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
Bucklebar, f-l Typic Haplargids		Avg. 59-7, 66-8, 68-4	Same as $CaC0_3$
Sonoita, c-l Typic Haplargids		92-3	92-3
SND #1, 2, c-l Typic Haplocalcids*		Avg. 59-9, 59-12	Same as $CaC0_3$
Streamwash (miscellaneous area)	10		
Other inclusions:	10		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Canutio,l-sk Typic Torriorthents		66-3	66-3
Delnorte, l-sk sh Typic Petrocalcids		Avg. 60-10, 66-2	Same as $CaC0_3$
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

* In this map unit, includes soils as thin as 2 feet (60 cm) over buried Typic Haplargids and Typic Calciargids.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in a broad belt of dissected terrain on the east side of the valley. The unit has both land-surface soils and once-buried soils that have now been exhumed or nearly exhumed by deep dissection associated with valley downcutting. The soils have formed in sediments derived mostly from rhyolite in the southern part of the belt; northward, there are increasing amounts of andesite and monzonite in the alluvium. Elevations range from about 4,250 to 4,500 feet.

The area has been dissected by arroyos and gullies. Narrow ridges are the dominant landform. Ridge crests are Picacho, Tortugas, or Jornada I and generally slope about 2 percent to the west. Steep ridge sides are young surfaces that bevel both the land-surface soils along the edge of the ridge crest and the underlying buried soils downslope on the ridge side.

The vegetation consists of creosotebush, snakeweed, tarbush, whitethorn, bush muhly, fluffgrass, three-awn, tobosa, and dropseed.

Whitlock-Berino-Rilloso Complex (11YA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First four soils:	65		
BERINO, f-l Typic Calciargids		Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
NICKEL, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
RILLOSO, s Typic Haplocalcids		60-11	60-2
WHITLOCK, c-l Typic Haplocalcids		60-2	60-2
Streamwash (miscellaneous area)	10		
Other inclusions:	25		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Bucklebar, f-l Typic Haplargids		Avg. 59-7, 66-8, 68-4	Same as $CaC0_3$
Delnorte, l-sk Typic Petrocalcids		Avg. 60-10, 66-2	Same as $CaC0_3$
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

Location, Parent Materials, Landscape, and Vegetation

These soils occur north and northwest of Goat Mountain. Most of the soils have formed in rhyolite alluvium derived from the Dona Ana Mountains, but in places exhumed, once-buried soils have formed partly or wholly in sediments of the Upper Camp Rice Formation (fluvial facies). Elevations range from 4,300 to 4,400 feet.

All areas have been strongly dissected, and ridges are the dominant landform. Ridge crests slope from about 3 to 5 percent to the south. Buried soils occur in all areas of this unit and commonly outcrop or occur at shallow depths on the sides of the ridges.

The vegetation is dominantly creosotebush; mesquite also occurs in places.

Caralampi Complex (12MO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	35		
CARALAMPI, l-sk Ustic Haplargids		59-14	Avg. 59-14, 60-23
NOLAM, l-sk Ustic Calciargids		60-2	Avg. 59-14, 60-23
Next four soils:	40		
Earp, l-sk Aridic Argiustolls		---	Avg. sites B, 33, OMF
Terino, l-sk, sh Ustalfic Petrocalcids		70-8	Avg. 59-14, 60-23
Terino, mod. deep analog, l-sk Ustalfic Petrocalcids		70-8	0.86% to 18 cm
Mierhill, l-sk, sh Petrocalcic Paleustolls		70-8	0.86% to 18 cm
Streamwash (miscellaneous area)	10		
Holliday, l-sk Ustic Haplargids	5	---	Avg. sites 2-4, OMF
Other inclusions:	10		
Aladdin, c-l Typic Haplustolls			59-1
Baylor, s-sk Torriorthentic Haplustolls		---	Avg. sites 1, 6 OMF
Monterosa, l-sk, sh Ustic Petrocalcids		66-2	0.72% to 18 cm
Onate, c-l Aridic Argiustolls		---	59-1
Santo Tomas, l-sk, Pachic Haplustolls		---	60-12
Hathaway, l-sk Aridic Calciustolls	$<1/2$		
Hathaway, s-sk analog, s-sk Aridic Calciustolls	$<1/2$		
Hayner, mollic analog, c-sk Petrocalcic Paleustolls	$<1/2$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the central and northern parts of the Organ Mountains. The soils have formed in sediments derived mostly or wholly from monzonite; smaller amounts of rhyolite, andesite, and/or limestone generally are in the alluvium. Elevations range from 4,800 to 6,000 feet.

Most of the soils occur on remnants of high Jornada fans extending westward from the mountain canyons and on Organ terraces between the Jornada remnants. Piles of cobbles and boulders are common on the steeper slopes. The sediments have been cut by arroyos and in places have been trenched to depths of several meters or more. Slopes are mainly about 10 to 20 percent but range from about 5 to 40 percent.

There is a wide variety of vegetation, including catclaw, pricklypear, beargrass, indigobush, sideoats grama, black grama, blue grama, sprangletop, cottontop, cholla, bristlegrass, *Yucca baccata*, sotol, sumac, mariola, winterfat, and barrel cactus.

Cruces Soils (12P)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CRUCES, l, sh Argic Petrocalcids	40	Avg. 66-12, 61-7	Same as $CaC0_3$
Cacique, f-l Argic Petrocalcids,	10	Avg. 66-12, 61-7	70-7
Hueco, c-l Argic Petrocalcids	10	Avg. 61-7, 66-12	Avg. 90-2, 90-3, 90-5
Rotura, fine-loamy analog, f-l Typic Petroargids	10	65-7	65-7
Bluepoint, Typic Torripsamments	10	66-13, 68-1	Same as $CaC0_3$
Next three soils:	15		
Berino, f-l Typic Calciargids		68-3	68-8
Simona, l, sh Typic Petrocalcids		Avg. 61-7, 66-12	Same as $CaC0_3$
Tonuco, s, sh Typic Petrocalcids		Avg. 66-12, 61-7	61-7
Next two soils:	5		
Rotura, c-l Typic Petroargids		Avg. 61-7, 66-12	61-7
Tencee, l-sk, c, sh Typic Petrocalcids		Avg. 61-7, 66-12	61-7
Cacique, fine analog, f Argic Petrocalcids	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur southwest of Picacho Mountain, north of Fort Selden, and near Goat Mountain. The soils have formed mainly in noncalcareous sand (with a few rounded pebbles) of the Camp Rice Formation (fluvial facies). Elevations range from about 4,300 to 4,500 feet.

These soils occur on La Mesa surface, a relict basin floor. They are generally undissected, except along the scarp next to the valley; there are no arroyos or gullies. The surface is very gently undulating with broad, very slight depressions between very slight ridges. On the La Mesa surface southwest of Picacho Mountain, slopes increase near the scarp and range from about 1 to 3 percent. Coppice dunes are common in places, especially in the southern part of the area and near the scarp. North of Fort Selden, the soils are level adjacent to the scarp; north of the scarp, slopes increase, ranging from 2 to 5 percent.

Snakeweed and mesquite occur over much of the area. Mesquite is dominant on coppice dunes; four-wing saltbush also occurs on some dunes. Buckthorn, tarbush, and creosotebush occur less frequently, mainly adjacent to black grama or tobosa; these are best developed in the area fenced in by the Las Cruces International Airport.

Hachita and Pinaleno Soils (12R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HACHITA, l-sk, sh Argic Petrocalcids	50	Avg. 59-16, 70-8	Same as $CaC0_3$
PINALENO, l-sk Typic Calciargids	20	Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Streamwash (miscellaneous area)	10		
Casito, l-sk, sh Argic Petrocalcids	5	Avg. 60-1, 59-16, 70-8	Same as $CaC0_3$
Delnorte, l-sk, sh Typic Petrocalcids	5	Avg. 60-1, 59-16, 70-8	Avg. 61-10, 66-2
Other inclusions:	10		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as CaC03
Canutio, l-sk (calc) Typic Torriorthents		66-3	66-3
Hap, f-l Typic Calciargids		60-7	60-7
Nickel, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Hachita, mod. deep analog l-sk Ustalfic Petrocalcids		70-8	70-8
Tres Hermanos, f-l Typic Calciargids		61-4	61-4

Location, Parent Materials, Landscape, and Vegetation

These soils occur extensively west of the southern portion of the Organ Mountains. Smaller areas also flank Goat and Picacho Mountains. In the southern part of the area west of the Organ Mountains, the soils have formed in alluvium that is derived from virtually 100 percent rhyolite. Northward, rhyolite is still dominant, but there are smaller amounts of andesite and monzonite in the alluvium. Elevations range from about 4,400 to 5,400 feet.

In their major area of occurrence, west of the Organ Mountains, these soils commonly occur on a broad fan piedmont. Although the soils have been cut by arroyos and gullies, many transverse slopes between drainageways are unrounded or have been only slightly rounded by erosion. Slopes range from about 8 percent next to the mountains to 2 percent at lower elevations. In areas downslope from Goat and Picacho Mountains, the soils occur on small alluvial fans. Slopes in these areas range from about 3 to 15 percent.

The vegetation consists mostly of ratany, fluffgrass, whitethorn, pricklypear, Mormon tea, bush muhly, desertthorn, tarbush and *Yucca baccata*. Creosotebush occurs in places, particularly at the lower elevations and on the more dissected terrain.

Terino Soils (12RA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TERINO, l-sk, sh Ustalfic Petrocalcids	55	70-8	Avg. 59-14, 60-23
Nolam, l-sk Ustic Calciargids	10	Avg. 59-13, 59-15	Avg. 59-14, 60-23
Terino, mod. deep analog, l-sk Ustalfic Petrocalcids	10	70-8	Avg. 59-14, 60-23
Mierhill, l-sk, sh Petrocalcic Paleustolls	10	70-8	0.86% to 18 cm
Next nine inclusions:	15		
Boracho, l-sk, sh Petrocalcic Calciustolls		70-8	0.8 6% to 18 cm
Baylor, s-sk Torriorthentic Haplustolls		---	Avg. sites 1, 6 OMF
Caralampi, l-sk Ustic Haplargids		59-14	59-14
Holliday, l-sk Ustic Haplargids		---	Avg. sites 2-4, OMF
Streamwash (miscellaneous area)			
Monterosa, l-sk, sh Ustic Petrocalcids		66-2	0.72% to 18 cm
Polar, l-sk Ustic Haplocalcids		Avg. 59-13, 60-2, 60-11	0.72% to 18 cm
Bodecker, s-sk Ustic Torriorthents		59-3	59-3
Terino, deep analog, l-sk Ustic Petroargids		70-8	Avg. 59-14, 60-23
Whitlock, Ustic analog, c-l Ustic Haplocalcids	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur mostly west of Soledad and Ice Canyons of the Organ Mountains, where the soils have formed mostly in alluvium derived from rhyolite, in places with a small amount of monzonite and andesite. Smaller areas of these soils occur below Quartzite Mountain in the San Andres Mountains, where the soils have formed in sediments derived from rhyolite, in places with some quartzite and sedimentary rocks. Elevations range from 4,800 to 5,600 feet.

Most of the soils occur on Jornada fans, with smaller areas on Dona Ana fans. Minor areas of Organ sediments occur on the sides of the fan remnants and on terraces between them. Slopes range from 7 to 15 percent.

The vegetation consists mostly of ratany, fluffgrass, whitethorn, and pricklypear; in places there are Mormon tea, bush muhly, desertthorn, tarbush, and *Yucca baccata*. Creosotebush occurs in places, particularly at the lower elevations and on the more dissected terrain. Scattered clumps of black grama, blue grama, and sideoats grama occur in places at the higher elevations.

Hayner Complex (12RO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HAYNER, c-sk Ustalfic Petrocalcids	60	60-5	60-5
Other soils:	40		
Hayner, fine analog, f Ustalfic Petrocalcids		60-5	60-5
Terino, clayey-skeletal analog, c-sk, sh Ustalfic Petrocalcids		60-5	60-5
Terino, clayey analog, c, sh Ustalfic Petrocalcids		60-5	60-5
Hayner, mollic analog, c-sk Petrocalcic Paleustolls		60-5	60-12

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area in Ice Canyon of the Organ Mountains. The soils have formed in sediments derived from rhyolite. Elevations range from about 5,860 to 5,880 feet.

These soils occur on the crest of a Dona Ana ridge remnant that has been protected from erosion by adjacent bedrock outcrops. The ridge crest is nearly level transversely for a few meters and has a longitudinal slope of 8 to 9 percent to the west.

The vegetation on the ridge crest is mainly snakeweed, mesquite, pricklypear, whitethorn, and mariola; there are scattered clumps of black grama and sideoats grama.

Eloma Complex (12ROA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ELOMA, c substratum analog, c-sk Ustic Haplargids	60	---	60-5
Next eight soils:	40		
Earp, c-sk analog, c-sk Aridic Argiustolls		---	60-5
Earp, c-sk, calcic analog, c-sk Aridic Argiustolls		59-15	60-5
Earp, f analog, f Aridic Argiustolls		---	60-12
Eloma, f analog, f Ustic Haplargids		---	---
Hayner, c-sk Ustalfic Petrocalcids		60-5	60-5
Hayner, f analog, f Ustalfic Petrocalcids		60-5	60-5
Hayner, mollic analog, c-sk Petrocalcic Paleustolls		60-5	60-12
Limpia, c-sk Pachic Argiustolls		---	60-12
Rock outcrop (miscellaneous area)	$<\frac{1}{2}$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area in Ice Canyon of the Organ Mountains. The soils have formed in sediments derived from rhyolite. Elevations range from about 5,700 to 5,870 feet.

These soils occur mostly on Jornada sides of a Dona Ana ridge remnant (map unit 12RO) that has been protected from erosion by adjacent bedrock outcrops. Most areas on the ridge sides slope 30 to 45 percent; the upper parts are not so steep.

On south-facing ridge sides, the dominant vegetation is tarbush, whitethorn, mariola, catclaw, snakeweed, mesquite, black grama, and *Yucca baccata*. Scattered juniper and pinyon occur on the north and east sides of the ridges. On the north-facing sides of ridges, there is more grass, mostly blue grama. There are also fewer shrubs, which consist mostly of small oak, $\frac{1}{2}$ to 1 meter high, snakeweed, and scattered juniper trees.

Hachita-Pinaleno Complex (12RR)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HACHITA, l-sk, sh Argic Petrocalcids	40	Avg. 59-16, 60-1	Same as $CaC0_3$
PINALENO, l-sk Typic Calciargids	30	Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents	5	Avg. 60-3, 61-6	Same as $CaC0_3$
Delnorte, l-sk, sh Typic Petrocalcids	5	Avg. 66-2, 60-10	Same as $CaC0_3$, plus 67-2 (0.45% to 18 cm)
Casito, l-sk, sh Argic Petrocalcids	5		
Nickel, l-sk Typic Haplocalcids	5	Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Other inclusions:	10		
Berino, f-l Typic Calciargids		60-7	60-7
Canutio, l-sk (calc) Typic Torriorthents		66-3	66-3
Onite, c-l Typic Haplargids		62-3	62-3
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils occur east, northeast, and southeast of Tortugas Mountain. The parent materials are sediments derived mainly from rhyolite; in the northern part of the unit, there are small amounts of andesite in the alluvium. Elevations range from about 4,300 to 4,600 feet.

These soils occur mostly on Picacho terraces that are inset against alluvium underlying the Jornada I or Tortugas surfaces. While the soils have been cut by small arroyos and gullies along the terrace margins, the central portions of the terraces are relatively stable and level transversely. Longitudinal slopes are about 2 percent.

The vegetation consists mainly of creosotebush, ratany, mesquite, and pricklypear. Whitethorn and snakeweed also occur in places.

Hachita-Casito Complex (12V)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CASITO, l-sk, sh Argic Petrocalcids	25	60-1, 59-16, 70-8	Same as $CaC0_3$
HACHITA, l-sk, sh Argic Petrocalcids	25	Avg. 59-16, 70-8	Same as $CaC0_3$
SOLEDAD, l-sk Typic Haplargids	20	67-4	67-4
Pinaleno, l-sk Typic Calciargids	10	Avg. 59-13, 60-2, 60-11	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents	5	Avg. 60-3, 66-3	Same as $CaC0_3$
Delnorte, l-sk, sh Typic Petrocalcids	5	Avg. 60-1, 59-16, 70-8	Avg. 61-10, 66-2
Other inclusions:	10		
Arizo, s-sk Typic Torriorthents		61-6	61-6
Streamwash (miscellaneous area)			

Location, Parent Materials, Landscape, and Vegetation

These soils are east of the Dona Ana Mountains and have formed in alluvium derived mainly from monzonite and mixed volcanic rocks—andesite, rhyolite, and latite. Elevations range from about 4,400 to 4,800 feet.

These soils occur on the Jornada fan piedmont. Arroyos are common and have dissected the sediments in many places. Small drainageways extend laterally from the arroyos, causing varying degrees of soil truncation. Longitudinal slopes range from about 3 to 5 percent.

The vegetation consists mainly of creosotebush, with a few tarbush, mesquite, and *Yucca baccata* plants.

Terino Analogs (123R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First three soils:	80		
NOLAM, l-sk Ustic Calciargids		Avg. 59-13, 59-15	Avg. 59-14, 60-23
TERINO, deep analog, l-sk, Ustalfic Petroargids		70-8	Avg. 59-14, 60-23
TERINO, mod. deep analog, l-sk Ustalfic Petrocalcids		70-8	Avg. 59-14, 60-23
Caralampi, l-sk Ustic Haplargids	10	59-14	Avg. 59-14, 60-23
Next five components:	10		
Baylor, s-sk Torriorthentic Haplustolls		---	Avg. sites 1, 6 OMF
Holliday, l-sk Ustic Haplargids		---	Avg. sites 2-4, OMF
Monterosa, l-sk, sh Ustic Petrocalcids		66-2	0.79% to 18 cm (SA 22)
Streamwash (miscellaneous area)			
Terino, l-sk, sh Ustalfic Petrocalcids		70-8	70-8
Rhyolite rock outcrop	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of Soledad and Ice Canyons of the Organ Mountains. The soils have formed in sediments derived mainly from rhyolite; in places there are small amounts of andesite. Elevations range from 4,900 to 5,800 feet.

These soils occur on fans and terraces near the mountains. The soils and sediments have been cut by arroyos. Slopes range from 4 to 8 percent.

The vegetation includes mesquite, *Yucca baccata*, snakeweed, fluffgrass, tarbush, and a few clumps of black grama and blue grama at the higher elevations.

Arizo Complex (13F)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ARIZO, s-sk Typic Torriorthents	25	Avg. 60-3, 61-6	Same as $CaC0_3$
STREAMWASH (miscellaneous area)	25		
Bluepoint, Typic Torripsamments	10	59-17	59-17
Yturbide, Typic Torripsamments	10	Avg. 60-3, 61-6	61-6
Other inclusions:	30		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 59-10, 66-16	Same as $CaC0_3$
Typic Haplocalcids		Avg. 60-2, 60-11	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents		66-3	66-3
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Pajarito, c-l Typic Haplocambids		67-3	67-3
Soledad, l-sk Typic Haplargids		66-16	66-16
Tugas, s-sk Typic Haplocambids		66-16	66-16
Vado, l-sk Typic Haplocambids		66-16	66-16

Location, Parent Materials, Landscape, and Vegetation

These soils occur on the eastern side of the valley border and extend eastward along major arroyos towards the Dona Ana and Organ Mountains. The parent materials were derived from source areas upslope, including the mountains. In the higher areas near the mountains, the parent materials consist largely of sediments derived from rhyolite; in places there are additions derived from andesite and monzonite. Towards the flood plain, sediments from the sand and rounded gravel of the Camp Rice Formation (fluvial facies) are an important component of the parent materials. Elevations range from about 3,900 to 4,700 feet.

The landscape consists of arroyo channels and Fillmore terraces inset against sediments of adjacent higher surfaces. The terraces extend headward along large arroyos and commonly range from about $^1/_2$ to 2 m higher than the channels. Slopes range from about 2 percent adjacent to the valley to 3 percent near the mountains.

The vegetation on the terraces is mostly creosotebush. There is generally little or no vegetation in the main channels of the arroyos, but large shrubs are common along channel margins. These shrubs are mainly desert willow, Mormon tea, creosotebush, brickellbush, sumac, Apache plume, and burrobrush.

Dalian Complex (13G)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DALIAN, l-sk, c Typic Torriorthents	30	66-4	66-4
DALIAN, s-sk analog, s-sk, c Typic Torriorthents	30	66-4	66-4
Streamwash (miscellaneous area)	10		
Next three soils:	30		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Glendale, f-s (calc) Typic Torrifluvents		60-15	60-15
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Rock outcrop	<1/2		
Typic Haplocalcids	<1/2		
Typic Petrocalcids	<1/2		

Location, Parent Materials, Landscape, and Vegetation

These soils occur primarily east and south of the Robledo Mountains. There are also smaller areas west of the northern part of the Dona Ana Mountains. The soils have formed in alluvial-fan sediments derived primarily from limestone and calcareous sandstone, in places with some rhyolite. Elevations range from about 3,950 to 4,400 feet.

These soils occur mostly on Fillmore terraces and fans, but in a few small areas, they are on older surfaces. The Fillmore terraces are inset against older sediments underlying higher surfaces, commonly the Picacho. These older sediments have been very deeply incised, especially along the eastern front of the Robledo Mountains. The Fillmore sediments, in turn, have been trenched by arroyos to depths ranging from about 1/2 to 2 m. The greatest entrenchment is next to the flood plain. Slopes range from 2 to 8 percent.

The soils have been disturbed by cultivation in many places near the flood plain. The native vegetation consists of creosotebush, mesquite, pricklypear, Mormon tea, tarbush, and four-wing saltbush.

Glendale-Reagan Complex (13L)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First four soils:	85		
GLENDALE, f-s (calc) Typic Torrifluvents		60-15	60-15
CROWFLATS, f-s (calc) Ustic Torrifluvents		60-15	60-15
REAGAN, f-s Ustic Haplocalcids		60-14	60-14
REAKOR, f-s Typic Haplocalcids		60-14	60-15
Next five soils:	15		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-3, 65-4	Same as $CaCO_3$
Dalian, l-sk, c Typic Torriorthents		66-4	66-4
Mescal, f-l (calc) Typic Torriorthents		60-15	60-15
Overwash phases of buried Calciargids and Haplocalcids		60-18	60-18
Tome, f-s (calc) Typic Torriorthents		60-15	60-15
Shallow Petrocalcids	<1/2		

NOTE: Organ and Isaacks' Ranch alluvial sediments tend to thin at their downslope and other margins, where buried soils are relatively shallow. Refer to the section "Buried Soils" for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the San Andres Mountains. The soils have formed in sediments derived primarily from limestone, calcareous sandstone, siltstone, and shale, in places with andesite, rhyolite, granite, and quartzite. Elevations range from about 4,300 to 4,800 feet.

Most of the soils occur on the fan piedmont of Organ age and are nearly level transversely. Scarplets are common in many areas and range from a few centimeters to 1 meter or more in height. Small drainageways occur downslope from the scarps. There are no large arroyos. Slopes range from 2 percent in the eastern part of the unit to about 1 percent in the western part.

The vegetation is mostly burrograss, tarbush, and creosotebush, with scattered clumps of tobosa in places. Many areas are barren.

Herbel Soils, Torrifluvents, and Haplocalcids (13LG)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HERBEL, c-l (calc) Typic Torriorthents	45	Avg. 65-3, 65-4	Same as $CaC0_3$
Next seven soils:	40		
Arizo, s-sk Typic Torriorthents		Avg. 65-3, 65-4	Same as $CaC0_3$
Mescal, f-l (calc) Typic Torriorthents		Avg. 65-3, 65-4	60-15
Yturbide, Typic Torripsamments		Avg. 65-3, 65-4	Same as $CaC0_3$
Caliza, s-sk Typic Haplocalcids		60-14	Avg. 65-3, 65-4
Nickel, l-sk Typic Haplocalcids		60-14	Avg. 65-3, 65-4
Reagan, f-s Typic Haplocalcids		60-14	60-15
Overwash phases of buried Calciargids and Haplocalcids		60-18	60-18
Next four soils:	10		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-2	65-2
Anthony, loamy-skeletal analog, l-sk (calc) Typic Torrifluvents		65-2	65-2
Glendale, f-s (calc) Typic Torrifluvents		60-15	60-15
Glendale, fine-loamy analog, f-l (calc) Typic Torrifluvents		60-15	60-15
Streamwash (miscellaneous area)	5		

NOTE: Organ and Isaacks' Ranch alluvial sediments tend to thin at their downslope and other margins, and buried soils are relatively shallow. Refer to the section "Buried Soils" for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the San Andres Mountains. The soils have formed in alluvium derived mainly from limestone, sandstone, and shale, with lesser amounts of rhyolite, granite, quartzite, and/or andesite. Elevations range from about 4,400 to 5,100 feet.

Near the mountains, the soils commonly occur on terraces inset against higher, older sediments. Downslope, the soils occur in sediments that spread out and bury older soils. Arroyos and gullies are common, especially near the mountains. Slopes range from 5 percent near the mountains to 1 percent at lower elevations.

The vegetation consists mostly of creosotebush; in places there are mesquite, fluffgrass, snakeweed, *Yucca baccata*, soaptree yucca, pricklypear, Mormon tea, tarbush, and alkali sacaton.

Herbel Soils (13ML)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HERBEL, c-l (calc) Typic Torriorthents	50	91-11	91-11
Next six soils:	45		
Canutio, l-sk (calc) Typic Torriorthents		Avg. 60-3, 66-3	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-2, 65-3, 65-4	Same as $CaC0_3$
Overwash phases of buried Calciargids		60-18	60-18
Glendale, f-s (calc) Typic Torrifluvents		60-15	60-15
Glendale, fine-loamy analog, f-l (calc) Typic Torrifluvents		60-15	60-15
Streamwash (miscellaneous area)	5		

NOTE: Organ and Isaacks' Ranch alluvial sediments tend to thin at their margins, where buried soils (mostly buried Calciargids of Jornada age) are relatively shallow. Refer to the section "Buried Soils" for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one large area west of the southern part of the San Andres Mountains and the northern part of the San Agustin Mountains. The soils have formed in sediments derived mainly from monzonite, with small amounts of limestone, calcareous sandstone, siltstone, and shale. Elevations range from about 4,420 to 4,890 feet.

These soils occur on an Organ fan piedmont that is strongly dissected in the upper part, with slight, narrow ridges. The lower part is less dissected or undissected. Slopes range from 4 percent in the eastern part of the unit to 2 percent in the western part.

The vegetation consists mostly of creosotebush and mesquite on dissected terrain. Some of the less dissected areas also have bush muhly, fluffgrass, and tarbush.

Herbel Complex (103ML)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HERBEL, c-l (calc) Typic Torriorthents	45	Avg. 61-5 (0-86 cm) and 91-11 (0-99 cm)	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents	10	Avg. 60-3, 66-3	Same as $CaC0_3$
Anthony, c-l (calc) Typic Torrifluvents	10	Avg. 60-3, 66-3	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents	10	Avg. 60-3, 61-6	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Other inclusions:	20		
Onite, c-l Typic Haplargids		Avg. 62-3, 70-5	Same as $CaC0_3$
Mescal, f-l (calc) Typic Torriorthents		66-8	66-8
Hap, f-l Typic Calciargids		60-7	60-7
Nickel, l-sk Typic Haplocalcids		60-11	60-11
Overwash phases of buried soils, mostly Calciargids		60-7	60-7
C-1, l-sk Typic and Pachic Haplustolls		Avg. 60-19, 60-12	Same as $CaC0_3$
Aladdin, calcic analog, c-l Aridic Calciustolls	<½		

NOTE: Organ and Isaacks' Ranch alluvial sediments tend to thin at their downslope and other margins, where buried soils (mostly buried Argids) are relatively shallow. Refer to "Buried Soils" section for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one large area near the mountain front, west of the central part of the Organ Mountains. The soils have formed in alluvium derived mostly from monzonite, with smaller amounts of rhyolite, limestone, and sandstone. Elevations range from about 4,700 to 5,100 feet.

Ridges (mostly Isaacks' Ranch and Organ surfaces) are the dominant landforms. In places narrow terraces of later Organ age are inset against the ridges. The sediments have been cut by arroyos and large gullies. Slopes along the ridge crests range from 5 percent nearest the mountains to 2 percent at the lower elevations. Ridge sides commonly are steep and in places are vertical or nearly so.

Creosotebush is generally dominant. Tarbush and mesquite also occur in many places. A few four-wing saltbush, *Yucca baccata*, and buckwheat plants are in some areas, and black grama occurs in the highest areas.

Aladdin Analog (13LGO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ALADDIN, calc analog, c-l (calc) Pachic Haplustolls	60	60-19	60-19
SANTO TOMAS, calc analog, l-sk (calc) Pachic Haplustolls	35	60-19	60-19
Streamwash (miscellaneous area)	5		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area directly west of Lohman Canyon in the San Andres Mountains. The soils have formed in alluvial-fan sediments derived mainly from limestone, sandstone, siltstone, and shale, with smaller amounts of rhyolite, granite, and quartzite. Elevations range from about 5,200 to 5,300 feet.

These soils occur on an Organ fan that has been trenched by the arroyo from Lohman Canyon and cut by gullies in places. Slopes range from 5 to 6 percent.

The vegetation is fluffgrass, creosotebush, mesquite, soaptree yucca, barrel cactus, pricklypear, snakeweed, mariola, three-awn, dropseed, sumac, ocotillo, and a few clumps of black grama.

Onite and Pajarito Soils (13M)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	80		
ONITE, c-l Typic Haplargids		Avg. 62-3, 70-5	Same as $CaC0_3$
PAJARITO, c-l Typic Haplocambids		67-3	67-3
Bucklebar, f-l Typic Haplargids	5	Avg. 59-7, 68-4	Same as $CaC0_3$
Other inclusions:	15		
Anthony, c-l (calc) Typic Torrifluvents		59-4	59-4
Berino, f-l Typic Calciargids		60-7	60-7
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Streamwash (miscellaneous area)			
Vinton, s Typic Torrifluvents		59-4	59-4
Yturbide, Typic Torripsamments		60-3, 61-6	61-6
Yucca, c-l Typic Calciargids		88-2	88-2
Onite, sandy subsoil analog, s Typic Haplargids		68-3	68-3
Onite, thin solum analog, c-l Typic Haplargids		68-5	68-5

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the northern part of the Organ Mountains. The soils have formed in alluvium derived primarily from monzonite, in places with minor amounts of andesite and rhyolite. Elevations range from about 4,300 to 4,600 feet.

Most of the soils occur on the fan piedmont and ridges of Organ age. The ridges are subdued, and the landscape is gently undulating transversely. Arroyo and gullies have trenched the sediments in places. Arroyo channels rise to the general level of the landscape in some areas, and historical fans have been deposited. A few long, narrow ridges of Organ sediments extend from the main part of the Organ sediments towards the basin floor. Slopes are 2 percent over most of the area and grade to 1 percent near the basin floor. There are a few gullies but no large arroyos. Slopes range from 2 to 3 percent.

The vegetation generally consists of scattered snakeweed, soaptree yucca, and Mormon tea. Black grama occurs in a very few areas, such as the vicinity of Pajarito 67-3. A few creosotebushes occur in places.

Bucklebar Complex (13MA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BUCKLEBAR, f-l Typic Haplargid	35	59-7	59-7
BUCKLEBAR, USTIC ANALOG, f-l Ustic Haplargids	35	59-6	59-6
YUCCA, c-l Typic Calciargids	25	Avg. 90-100, 101	Avg. 90-100, 101
Other soils:	5		
Berino, f-l Typic Calciargids		60-7	60-7
Amole, s Typic Torriorthents		92-2	92-2
Bluepoint, Typic Torripsamments		92-1	92-1

Location, Parent Materials, Landscape, and Vegetation

These soils are in one area astride Highway 70 and west of Organ. The soils have formed in sediments derived mostly from monzonite, in places with minor amounts of rhyolite, limestone, and calcareous sandstone. Elevations range from 4,460 to 4,660 feet.

These soils occur in a broad drainageway of Isaacks' Ranch age. This is the largest known area of Isaacks' Ranch sediments. Occasional gullies cut the sediments. Slopes are 1 percent to the west.

The vegetation consists mostly of tobosa, mesquite, creosotebush, tarbush, snakeweed, four-wing saltbush, fluffgrass, dropseed, and in places a few soaptree yuccas.

Onite, Yturbide, and Herbel Soils (13MB)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First four soils:	95		
ONITE, c-l Typic Haplargids		Avg. 62-3, 70-5	Same as CaC03
FINE-LOAMY TYPIC CALCIARGIDS		61-4	61-4
YTURBIDE, Typic Torripsamments		Avg. 60-3, 61-6	Same as $CaC0_3$
HERBEL, c-l (calc) Typic Torriorthents		91-11	91-11
Streamwash (miscellaneous area)	5		
Bluepoint, Typic Torripsamments	<1/2	59-17	59-17

NOTE: Organ sediments tend to be quite thin downslope from the Dona Ana Mountains (a relatively small mountain range), and buried soils, mostly Calciargids of Jornada age, are relatively shallow. Refer to the section “Buried Soils” for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur north and east of the Dona Ana Mountains. The soils have formed in sediments derived mostly from monzonite; minor amounts of sedimentary rocks occur in the sediments east of the mountains. Elevations range from about 4,330 to 4,650 feet.

These soils occur on the Organ and Jornada fan piedmonts. Small drainageways are common in this unit. Slopes range from 3 percent near the mountains to 2 percent downslope.

The vegetation consists mostly of creosotebush, mesquite, soaptree yucca, snakeweed, and fluffgrass, in places with bush muhly, *Yucca baccata*, and Mormon tea.

Bluepoint-Argids Complex (13MC)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BLUEPOINT, Typic Torripsamments	25	66-13	66-13
Next two soils:	65		
COARSE-LOAMY TYPIC HAPLARGIDS		Avg. 62-3, 70-5	Same as $CaC0_3$
FINE-LOAMY TYPIC CALCIARGIDS		Avg. 60-7, 61-4	Same as $CaC0_3$
Typic Haplocalcids and Petrocalcids	10	Avg. 60-2, 60-10, 66-2	Same as $CaC0_3$
Streamwash (miscellaneous area)	$<^1/_2$		

NOTE: Organ sediments tend to be quite thin downslope from the Dona Ana Mountains (a relatively small mountain range), and buried soils, mostly Calciargids of Jornada age, are relatively shallow. Refer to the section "Buried Soils" for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area north of the Dona Ana Mountains. The soils have formed in sediments derived from monzonite. Elevations range from 4,440 to 4,550 feet.

These soils occur on fan piedmonts of Organ and Jornada age and on coppice dunes. There are occasional slight drainageways. Slopes on the fan piedmonts range from 2 to 3 percent to the north.

The vegetation consists mostly of snakeweed, mesquite, and in places a few creosotebushes. The vegetation on the dunes is mostly mesquite, with a few four-wing saltbushes.

Yucca Sandy Loam (13MD)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
YUCCA, c-l Typic Calciargids	80	Avg. 90-100, 101	Avg. 90-100, 101
Inclusions:	20		
Bucklebar, f-l Typic Haplargids		59-7	59-7
Amole, s Typic Torriorthents		92-2	92-2
Bluepoint, Typic Torripsamments		92-1	92-1

Location, Parent Materials, Landscape, and Vegetation

These soils are in three small areas along and near Highway 70 and west of the town of Organ. The soils have formed in sediments derived mostly from monzonite, with smaller amounts of rhyolite, limestone, and sandstone. Elevations range from about 4,500 to 4,560 feet.

The soils are on slight ridges of Isaacks' Ranch age. They illustrate initial development of the calcic horizon and the Yucca series. They also illustrate the effects of a facies change to coarser textured materials in soils of the same age. Slopes are 1 percent to the west.

The vegetation consists of bush muhly, four-wing saltbush, dropseed, creosotebush, Mormon tea, fluffgrass, mesquite, and tarbush.

Onite Sandy Loam (13MM)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ONITE, c-l Typic Haplargids	75	Avg. 62-3, 70-5	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Other inclusions:	20		
Agustin, c-l Typic Haplocambids		60-8	59-3
Berino, f-l Typic Calciargids		60-7	60-7
Bucklebar, f-l Typic Haplargids		59-7	59-7
Hap, f-l Typic Calciargids		60-7	60-7
Pajarito, c-l Typic Haplocambids		67-3	67-3
Yucca, c-l Typic Calciargids		90-1	90-1

Location, Parent Materials, Landscape, and Vegetation

These soils occur north of the Dona Ana Mountains and west of the northern part of the Organ Mountains. The soils have formed in alluvium derived primarily from monzonite; in places there are minor amounts of andesite, rhyolite, and/or limestone in the alluvium. Elevations range from about 4,600 to 5,000 feet.

Most of the soils occur on the Organ fan piedmont and on slight to distinct ridges. Longitudinal slopes along the ridge crests range from about 5 percent at the higher elevations to 2 percent at the lower elevations. Transverse slopes of ridge sides range from about 2 to 10 percent. Most ridge crests are quite broad and are essentially level transversely for several tens of meters. Others are narrow and are level transversely for only several meters; in places, waterways extend laterally from arroyos up the ridge sides. Gullies are common and generally are in or parallel to old roads.

The vegetation consists mostly of scattered Mormon tea, pricklypear, and soaptree yucca. Creosotebush occurs in a few places, mainly on the slightly dissected, higher ridges of the map unit. Tarbush also occurs in some of these areas. There are scattered clumps of black grama in a very few places.

Onate Complex (13MO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ONATE, c-l Aridic Argiustolls	50	59-1	59-1
ALADDIN, c-l Aridic Haplustolls	25	59-1	59-1
Hawkeye, s Torriorthentic Haplustolls	10	59-2	59-2
Streamwash (miscellaneous area)	5		
Summerford, c-l Ustic Haplargids	5	60-8	59-3
Other inclusions:	5		
Monza, l-sk Ustic Haplargids		70-1	70-1
Hap, f-l Typic Calciargids		60-7	60-7
Bodecker, sandy analog, s Ustic Torriorthents		59-3	59-3

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the northern part of the Organ Mountains and have formed in alluvium derived from monzonite. Elevations range from about 4,600 to 5,600 feet.

These soils occur on Organ fans and terraces that are commonly inset against ridges of older alluvium or monzonite bedrock. Arroyos and gullies are common. Slopes range from about 13 percent next to the mountains to 4 percent in the western part of the unit.

The vegetation consists primarily of snakeweed, Mormon tea, soaptree yucca, fluffgrass, cholla and mesquite; there are scattered patches of black grama, and blue grama is at the highest elevations. Creosotebush occurs in a few places at the lower elevations.

Summerford Complex (13MOA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
SUMMERFORD, c-l Ustic Haplargids	45	82-1	82-1
Next five soils:	50		
Summerford, sandy analog, s Ustic Haplargids		82-1	82-1
Aladdin, c-l Typic Haplustolls		82-1	59-1
Bodecker, sandy analog, s Ustic Torriorthents		82-1	82-1
Hawkeye, s Torriorthentic Haplustolls		82-1	59-2
Onate, c-l Aridic Argiustolls		82-1	59-1
Streamwash (miscellaneous area)	5		
Whitlock, Ustic analog, c-l Ustic Haplocalcids	<½		
Rock outcrop	<½		
Argids with shallow bedrock	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in five areas around Summerford Mountain. The soils have formed in sediments derived from monzonite. Elevations range from 4,450 to 4,900 feet.

These soils occur on Organ fans that extend downslope from Summerford Mountain. Occasional drainageways and gullies have trenched the sediments. Slopes range from about 7 to 10 percent.

The vegetation is mostly black grama, mesquite, tarbush, Mormon tea, snakeweed, pricklypear, soaptree yucca, and burrograss.

Adelino Clay Loam (13P)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ADELINO, f-l Typic Haplocambids	90	66-8	66-8
Rotura, c-l Typic Petroargids	10	61-8	61-8

Location, Parent Materials, Landscape, and Vegetation

The only delineation of this map unit occurs along the border between the nearly level slopes of the lower La Mesa and the steeper slopes that grade to the scarp zone of the upper La Mesa to the west. Adelino soils overlie soils with Bt horizons similar to the Bt horizons of Rotura soils. These relationships indicate that the deposit in which Adelino soils have formed represents a localized period of sedimentation that is younger than La Mesa. The younger sediments must have been derived primarily from or below the scarp zone of the upper La Mesa, since they are directly downslope and are confined to a belt that parallels the scarp zone. Elevation is about 4,200 feet.

These soils occur in an elongate depression that is level or nearly level. Drainage from Organ sediments and the scarp zone of the upper La Mesa westward extends into the depression and in places has formed small fans along its western edge. There are a few small coppice dunes.

The vegetation consists of creosotebush, mesquite, tarbush, snakeweed, and patches of burrograss. There are many barren areas.

Soledad-Onite Complex (13R)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
SOLEDAD, l-sk Typic Haplargids	40	67-4	67-4
ONITE, c-l Typic Haplargids	35	Avg. 61-5, 62-3, 67-4, 70-5	Same as $CaC0_3$
Pinaleno, l-sk Tynic Calciargids	10	Avg. 59-13, 60-2, 60-11	Same as $CaCO_3$
Streamwash (miscellaneous area)	5		
Other inclusions:	10		
Arizo, s-sk Typic Torriorthents		60-3	60-3
Bucklebar, f-l Typic Haplargids		59-7	59-7
Pajarito, c-l Typic Haplocambids		67-3	67-3
Tugas, s-sk Typic Haplocambids		66-16	66-16
Vado, l-sk Typic Haplocambids		66-16	66-16

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the southern and middle parts of the Organ Mountains. In the southern part of the area, the soils have formed in sediments that are virtually 100 percent rhyolite. Northward, there are small amounts of andesite and monzonite in the alluvium. Elevations range from about 4,400 to 5,000 feet.

These soils occur on individual fans that extend outward from major canyons along the mountain front. In upslope areas, the soils commonly occur on narrow terraces inset against higher, older alluvium. Downslope, the sediments have spread out and buried older sediments and soils. The soils have formed in deposits of two general ages (Organ and Isaacks' Ranch, with Organ dominant), as is manifested in places by several levels of fans that differ slightly in elevation. In other places the soils of Isaacks' Ranch age are buried by soils of Organ age. Arroyos and gullies are common. Slopes range from 8 percent next to the mountains to 3 percent in the western part of the map unit.

The vegetation consists of snakeweed, Mormon tea, mesquite, fluffgrass, cholla, pricklypear, and a few creosotebush and bush muhly plants. Black grama occurs in a few places in the mountainward parts of the map unit.

Baylor, Santo Tomas, and Earp Soils (13RO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BAYLOR, s-sk Torriorthentic Haplustolls	35	60-12	Avg. sites 1, 6, OMF
SANTO TOMAS, l-sk Pachic Haplustolls	25	60-12	60-12
EARP, l-sk Aridic Argiustolls	20	60-12	Avg. sites B 33, OMF
Next three components:	10		
Minneosa, sandy-skeletal analog, s-sk Ustic Torrifluvents		60-12	60-12
Streamwash (miscellaneous area)			
Aladdin, c-l Aridic Haplustolls		60-12	59-1
Other inclusions:	10		
Caralampi, l-sk Ustic Haplargids		59-14	59-14
Hawkeye, s Torriorthentic Haplustolls		59-2	59-2
Santo Tomas, Cumulic analog, l-sk Cumulic Haplustolls		60-12	60-12

Location, Parent Materials, Landscape, and Vegetation

These soils occur in a number of small areas along the front of the southern portion of the Organ Mountains, in and adjacent to the mountain canyons. The soils have formed in alluvial-fan sediments derived from rhyolite. Elevations range from about 4,900 to 5,800 feet.

Most of the soils occur on Organ terraces inset against alluvium underlying older surfaces. The soils have been trenched by arroyos in many places. Slopes range from about 5 to 10 percent.

The vegetation consists of snakeweed, fluffgrass, black grama, blue grama (at the higher elevations), squawbush, mesquite, cholla, Apache plume, *Lippia Wrightii*, and pricklypear.

Herbel and Yturbide Soils (13S)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	55		
HERBEL, c-l (calc) Typic Torriorthents		Avg. 61-5 (0-86 cm) and 91-11 (0-99 cm)	Avg. 61-5 (0-86 cm) and 91-11 (0-85 cm)
YTURBIDE, Typic Torripsamments		Avg. 60-3, 61-6	61-1
STREAMWASH (miscellaneous area)	25		
Arizo, s-sk Typic Torriorthents	10	Avg. 60-3, 61-6	Same as $CaC0_3$
Bluepoint, Typic Torripsamments	10	59-17	59-17

Location, Parent Materials, Landscape, and Vegetation

These soils occur in three delineations south of Summerford Mountain. The soils have formed in sediments derived from mixed igneous rocks. Elevations range from 4,500 to 4,600 feet.

These soils occur in topographic lows occupied by arroyos and late Organ sediments occurring as low terraces along the arroyos. Slopes range from 2 to 4 percent.

The vegetation consists mainly of creosotebush, mesquite, bush muhly, zinnia, and snakeweed.

Herbel Complex (13V)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HERBEL, c-l (calc) Typic Torriorthents and overwash phases of buried soils, mostly Calciargids	55	Avg. 61-5 (0-86 cm) and 91-11 (0-99 cm)	Avg. 61-5 (0-86 cm) and 91-11 (0-85 cm)
Next four soils:	40		
Yturbide, Typic Torripsamments		Avg. 61-4, 2307, 2411, 91-11	Same as $CaC0_3$
Anthony, c-l (calc) Typic Torrifluvents		91-11	91-11
Pajarito, c-l Typic Haplocambids		67-3	67-3
Soledad, l-sk Typic Haplargids		Avg. 61-5, 67-4	Same as $CaC0_3$
Streamwash (miscellaneous area)	5		
Arizo, s-sk Typic Torriorthents	<1/2		
Canutio, l-sk (calc) Typic Torriorthents	<1/2		

NOTE: Organ sediments tend to be quite thin downslope from the Dona Ana Mountains (a relatively small mountain range), and buried soils, mostly Calciargids of Jornada age, are relatively shallow. Refer to the section "Buried Soils" for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in several areas east of the Dona Ana Mountains. The soils have formed in sediments derived from mixed igneous rocks. Elevations range from 4,340 to 4,500 feet.

Most of the soils occur on the Organ fan piedmont, but some soils on the Jornada fan piedmont are at or very near the surface. Slopes range from 2 to 4 percent.

The vegetation consists mostly of creosotebush, mesquite, bush muhly, zinnia, snakeweed, and tarbush.

Kokan, Yturbide, and University Soils (13X)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
KOKAN, s-sk Typic Torriorthents	25	Avg. 60-3, 61-6	Same as $CaC0_3$
YTURBIDE, Typic Torripsamments	25	Avg. 60-3, 61-6	61-6
UNIVERSITY, Typic Torripsamments	20	59-10, 93-1, 93-2	Same as $CaC0_3$
STREAMWASH (miscellaneous area)	15		
Next three soils:	15		
Caliza, s-sk Typic Haplocalcids		Avg. 59-13, 60-11	59-13
Rilloso, s Typic Haplocalcids		Avg. 59-13, 60-11	59-13
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Onite, c-l Typic Haplargids	<½		
Yucca, c-l Typic Calciargids	<½	88-2	88-2

Location, Parent Materials, Landscape, and Vegetation

These soils occur discontinuously along both sides of the valley border. On the west side of the valley, they are mostly south of Picacho Mountain, directly below the La Mesa scarp; there is also a small delineation in the northern part of the area. On the east side of the valley, there is one small delineation in the southern part of the area and a discontinuous belt near the flood plain north of Dona Ana. The soils have formed in the Camp Rice Formation (fluvial facies) and in surficial colluvium of Holocene age. The old alluvium has been exhumed from beneath the La Mesa surface south of Picacho Mountain and commonly from beneath the Picacho surface north of Dona Ana. Elevations range from about 3,900 to 4,200 feet.

These soils occur on ridges that range from slight to steep. On the west side of the valley, below the La Mesa scarp, the ridges are high and steep. There are common saddles in the ridges. Slopes along ridge crests range from about 1 to 5 percent. Ridge sides slope from about 15 to 35 percent, and gullies are numerous. In many places these sediments form a structural bench. Ridges are lower and less prominent on the east side of the valley.

The vegetation consists mainly of creosotebush; in places there are a few mesquite, snakeweed, fluffgrass, Mormon tea, and dropseed plants.

University and Bluepoint Soils (13Y)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	80		
BLUEPOINT, Typic Torripsamments		59-17	59-17
UNIVERSITY, Typic Torripsamments		Avg. 59-10, 93-1, 93-2	Same as $CaC0_3$
Yturbide, Typic Torripsamments	10	Avg. 60-3, 61-6	61-6
Other inclusions:	10		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 59-10, 66-16	Same as $CaC0_3$
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Pajarito, c-l Typic Haplocambids		67-3	67-3
Rilloso, s Typic Haplocalcids		60-11	60-11
Streamwash (miscellaneous area)			
Vinton, s Typic Torrifluvents		59-4	59-4

Location, Parent Materials, Landscape, and Vegetation

These soils occur extensively on both sides of the valley border, mainly in the southern part of the study area. Parent materials are largely reworked and in-place sandy sediments of the Camp Rice Formation (fluvial facies). Elevations range from about 3,900 to 4,400 feet.

These soils occur on terraces, fans and ridges that have commonly been dissected. Arroyos descend to the flood plain of the Rio Grande. In places side drainageways extend from arroyos towards the ridges. Rills and small gullies occur on many of the ridge sides. Coppice dunes are common on some of the ridge crests and fans. Longitudinal slopes of ridge crests range from about 2 to 5 percent; ridge sides slope mainly from 3 to 10 percent, with a few sloping 25 to 35 percent. Areas adjacent to the flood plain are commonly gently undulating and slope 2 to 3 percent.

The vegetation consists mainly of creosotebush, with scattered mesquite, sand dropseed, mesa dropseed, bush muhly, Mormon tea, soaptree yucca, ratany, and pricklypear. The vegetation on dunes is mainly mesquite, in places with four-wing saltbush or creosotebush.

University, Bluepoint, and Herbel Soils (13YA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
UNIVERSITY, Typic Torripsamments	30	Avg. 59-10, 93-1, 93-2	Same as $CaC0_3$
BLUEPOINT, Typic Torripsamments	35	59-17	59-17
HERBEL, c-l (calc) Typic Torriorthents	30	91-11	91-11
Inclusions:	5		
Streamwash (miscellaneous area)			
Sonoita, c-l Typic Haplargids		61-9	61-9

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area north of the western part of the Dona Ana Mountains. The soils have formed in sediments derived from the soils and sediments of the Camp Rice Formation (fluvial facies) upslope along and north of the La Mesa scarp. Elevations range from 4,400 to 4,500 feet.

These soils occur on a broad, north-facing slope that descends from the La Mesa scarp directly south, in Organ sediments that border small arroyos. Slopes range from 2 to 3 percent.

The vegetation consists mainly of creosotebush, mesquite, fluffgrass, and soaptree yucca.

Bucklebar and Onite Soils (14P)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BUCKLEBAR, f-l Typic Haplargids	55	Avg. 66-14, 59-7, 66-8, 68-4	Same as $CaC0_3$
ONITE, c-l Typic Haplargids	35	61-9, avg. 62-3, 70-5	Same as $CaC0_3$
Inclusions:	10		
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Caliza, s-sk Typic Haplocalcids		Avg. 59-13, 60-11	59-13
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Nickel, l-sk Typic Haplocalcids		Avg. 59-13, 60-2, 60-22	Same as $CaC0_3$
Simona, c-l, sh Typic Petrocalcids		Avg. 59-11, 60-10	Same as $CaC0_3$

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area in the vicinity of Fort Selden. They have formed in parent materials of mixed lithology but with little or no carbonate. The origin of the parent materials has not been precisely determined. It appears likely that the soils may have formed partly in sediments derived from higher slopes to the east, but some of the sediments may represent a flood-plain deposit. Elevations range from about 4,000 to 4,100 feet.

The Leasburg surface occurs primarily as two level or nearly level “flats” that differ only slightly in elevation. Bordering the flats are gentle to moderate slopes descending to the flood plain along the Rio Grande. Occasional gullies have cut the sediments on these slopes. Much of the area on the flats has been leveled to some degree for irrigation.

Most of this map unit is under cultivation. In a few undisturbed areas, the native vegetation is preserved and commonly consists of creosotebush, snakeweed, and mesquite. Scattered clumps of tobosa occur where the nongravelly soils are not under cultivation. The vegetation on the gravelly soils around the edges of the map unit consists of creosotebush and mesquite.

Caralampi Very Gravelly Sandy Loam (14RO)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CARALAMPI, l-sk Ustic Haplargids	80	59-14	Avg. 59-14, 60-23
Streamwash (miscellaneous area)	5		
Other inclusions:	15		
Baylor, s-sk Torriorthentic Haplustolls		---	Avg. sites 1, 6, OMF
Earp, l-sk Aridic Argiustolls		---	Avg. sites B, 33, OMF
Santo Tomas, l-sk Pachic Haplustolls		60-12	60-12

Location, Parent Materials, Landscape, and Vegetation

These soils occur in several areas in and west of Soledad Canyon in the Organ Mountains. The soils have formed in alluvium derived from rhyolite. Elevations range from about 5,500 to 6,000 feet.

The landscape consists of high remnants of alluvial fans that are mostly of Jornada I age. The remnants are separated from each other by arroyos that have deeply trenched the sediments. The crests of the remnants are commonly quite stable and level or nearly level transversely, but a few areas have been strongly dissected and rounded by arroyos. Longitudinal slopes along the ridge remnants are about 8 percent over most of the area, ranging to about 15 percent at the higher elevations.

The vegetation consists of snakeweed, whitethorn, pricklypear, black grama, blue grama, *Yucca baccata*, catclaw, bush muhly, cholla, mesquite, and Mormon tea.

Tres Hermanos-Onite Complex (14V)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TRES HERMANOS, f-l Typic Calciargids and overwash phase	30	Avg. 61-4, 2307, 2411	Same as $CaC0_3$
ONITE, c-l Typic Haplargids	30	61-5	61-5
Soledad, l-sk Typic Haplargids	5	67-4	67-4
Streamwash (miscellaneous area)	5		
Other inclusions:	30		
Anthony, c-l (calc) Typic Torrifluvents		91-11	91-11
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	61-6
Canutio, l-sk (calc) Typic Torriorthents		Avg. 60-3, 66-3	Same as $CaC0_3$
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

NOTE: Organ sediments tend to be quite thin downslope from the Dona Ana Mountains (a relatively small mountain range) and buried soils, mostly Calciargids of Jornada age, are relatively shallow. Refer to the section “Buried Soils” for classification of pedons with buried soils.

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one delineation east of the Dona Ana Mountains. The soils have formed in sediments derived from rhyolite, monzonite, andesite, and latite. Elevations range from about 4,350 to 4,500 feet.

Most of the soils occur on the Organ fan piedmont. Small drainageways are common, and there are several small arroyos. Transverse relief is gently undulating because of the drainageways. Longitudinal slopes range from 2 to 3 percent.

Scattered creosotebush, snakeweed, and Mormon tea are dominant on slight ridges; creosotebush, tarbush, desertthorn, and mesquite are dominant in drainageways.

Summerford Soils (14VA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
SUMMERFORD, c-l Ustic Haplargids	75	Avg. 62-3, 70-5	Same as $CaC0_3$
Next three soils:	20		
Hap, Ustic analog, f-l Ustic Haplargids		Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
Herbel, Ustic analog, c-l Ustic Torriorthents		91-11	91-11
Whitlock, Ustic analog c-l Ustic Haplocalcids		60-2	60-2
Streamwash (miscellaneous area)	5		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area south of Summerford Mountain. The soils have formed in sediments derived mostly from igneous rocks, such as andesite, with small amounts of sediments derived from sedimentary rocks, such as limestone. Elevations range from 4,580 to 4,660 feet.

These soils occur on Organ fans. Occasional drainageways and gullies have trenched the sediments. Slopes range from about 5 to 10 percent.

The vegetation is mostly snakeweed, zinnia, three-awn, *Yucca baccata*, fluffgrass, creosotebush, bush muhly, and mesquite.

Berino Association (15M)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BERINO, f-l Typic Calciargids	50	Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
MCALLISTER, f-l Ustic Calciargids	25	70-7	70-7
Bucklebar, f-l Typic Haplargids	10	Avg. 59-7, 66-8, 68-4	Same as $CaC0_3$
Onite, c-l Typic Haplargids	5	Avg. 62-3, 70-5	Same as $CaC0_3$
Next five components:	10		
Dona Ana, f-l Typic Calciargids		60-6	60-6
Headquarters, clayey subsoil analog, f Ustic Haplargids		69-8	69-8
Stellar, f Ustic Calciargids		68-9	60-21
Streamwash (miscellaneous area)			
Bluepoint, Typic Torripsamments		68-1	68-1
Cacique, f-l Argic Petrocalcids	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one large area west of the northern part of the Organ Mountains. The soils have formed in sediments derived primarily from monzonite. In places there are small amounts of sediments derived from rhyolite, andesite, and limestone. Elevations range from about 4,300 to 4,700 feet.

Most of the soils occur on the fan piedmont of Jornada age. The landscape is gently undulating transversely. There are occasional broad drainageways, commonly many meters wide, and a few very slight, discontinuous ridges. Gullies occur in many places, and some of them follow old roads from San Agustin Pass towards the Rio Grande Valley. There are no well defined arroyos. Drainage from arroyos entrenched in soils to the east continues across these soils in the broad drainageways or in the gullies. Slopes range from 3 percent nearest the mountains to 1 percent downslope.

In the stablest areas and in drainageways, there are stands or clumps of tobosa; elsewhere, there are snakeweed, mesquite, Mormon tea, soapweed, fluffgrass, three-awn, and a few creosotebushes.

Berino Sandy Loam (15MA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BERINO, f-l Typic Calciargids	75	Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
Bucklebar, f-l Typic Haplargids	10	Avg. 59-7, 66-8, 68-4	Same as $CaC0_3$
Onite, c-l Typic Haplargids	5	Avg. 62-3, 70-5	Same as $CaC0_3$
Other inclusions:	10		
Dona Ana, f-l Typic Calciargids		61-4	61-4
Headquarters, fine analog, f Ustic Haplargids		69-8	69-8
Stellar, f Ustic Calciargids		61-3	61-3
Streamwash (miscellaneous area)			
Yucca, c-l Typic Calciargids		90-1	90-1
Bucklebar, Ustic analog, f-l Ustic Haplargids		59-6	59-6

Location, Parent Materials, Landscape, and Vegetation

These soils occur north and east of the Dona Ana Mountains. The soils have formed in alluvium derived from monzonite. Elevations range from about 4,300 to 4,600 feet.

Most of the soils occur on the Jornada fan piedmont. The soils are undissected by arroyos; there are a few gullies and drainageways. Slopes range from 2 percent nearest the mountains to 1 percent on the lowest part of the fan piedmont.

The vegetation consists mainly of fluffgrass, Mormon tea, and mesquite. In a few areas there are scattered clumps of tobosa.

Berino-Bluepoint Complex (15MB)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BERINO, f-l Typic Calciargids	55	Avg. 60-7, 60-13, 68-9, 70-7	Same as $CaC0_3$
BLUEPOINT, Typic Torripsamments	30	68-1	68-1
Bucklebar, f-l Typic Haplargids	5	Avg. 59-7, 66-8, 68-4	Same as $CaC0_3$
Onite, c-l Typic Haplargids	5	Avg. 62-3, 70-5	Same as $CaC0_3$
Next two components:	5		
Stellar, f Ustic Calciargids		68-9	60-21
Streamwash (miscellaneous area)			
Whitlock, c-l Typic Haplocalcids	<1/2		

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the northern part of the Organ Mountains. Bluepoint soils occur on coppice dunes; the other soils have formed in alluvium derived from monzonite. Elevations range from about 4,350 to 4,480 feet.

Most of the soils occur on the Jornada fan piedmont and coppice dunes. Slopes range from 2 percent near the mountains to 1 percent on the lower part of the fan piedmont.

The vegetation on dunes is mostly mesquite, with a few four-wing saltbushes. Between dunes, the vegetation is mostly snakeweed, mesquite, Mormon tea, and fluffgrass. Many of the areas between dunes are barren.

Hap Gravelly Sandy Loam (15MG)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HAP, f-l Typic Calciargids	60	Avg. 60-7, 60-13, 68-9	Same as $CaCO_3$
Berino, f-l Typic Calciargids	10	Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
Bucklebar, f-l Typic Haplargids	10	59-7	59-7
Streamwash (miscellaneous area)	10		
Agustin, c-l Typic Haplocambids		60-8	59-3
Other inclusions:	10		
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Rilloso, s Typic Haplocalcids		60-11	60-11

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of the northern part of the Organ Mountains and the town of Organ. The soils have formed in sediments derived from monzonite. Elevation is about 4,900 feet.

Low ridges of Jornada age are characteristic. The ridges generally are separated by arroyos or small drainageways. Slopes along ridge crests range from 3 percent in the western part of the unit to 5 percent in the eastern part.

The vegetation consists of creosotebush, tarbush, soapweed, *Yucca baccata*, snakeweed, fluffgrass, and a very few clumps of tobosa in scattered areas. Bush muhly occurs at the base of shrubs in a few spots.

Rotura-Bluepoint Complex (15P)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ROTURA, c-l Typic Petroargids	45	Avg. 61-8 and HCM pedon	Same as $CaC0_3$
BLUEPOINT, Typic Torripsamments	30	66-13	66-13
Berino, f-l Typic Calciargid	10	68-2	68-2
Sonoita, c-l Typic Haplargids	10	72-3	72-3
Other inclusions:	5		
Algerita, c-l Typic Haplocalcids		61-2	61-2
Cruces, l, sh Argic Petrocalcids		61-8	61-75
Hueco, c-l Argic Petrocalcids		61-8	61-7
Simona, l, sh Typic Petrocalcids		61-8	61-7

Location, Parent Materials, Landscape, and Vegetation

This map unit is in one large area on the lower La Mesa, west of the Rio Grande Valley and south of Picacho Mountain. Bluepoint soils occur on coppice dunes; the other soils have formed in sediments of the Camp Rice Formation (fluvial facies). Elevation is about 4,200 feet.

The soils are on the lower La Mesa surface, a relict basin floor. The lower La Mesa is nearly level and is undissected, except along a scarp at the northern and eastern borders. There are scattered small (commonly a few tens of meters in diameter), roughly circular to slightly elongate depressions. The depressions are shallow—generally not more than several meters lower than the adjacent areas—and the bordering slopes are very gentle. Coppice dunes dominate the microrelief in most areas between the depressions.

The dunes generally have a dense cover of vegetation, mainly mesquite; a few four-wing saltbushes also occur on some of the dunes. Interdune areas are generally barren or have a few scattered snakeweeds. Creosotebush is common near the scarp. The depressions have quite a dense cover of mesquite, probably a reflection of more favorable moisture caused by runoff from adjacent areas. The dense mesquite causes the depressions to appear as darker areas on aerial photographs. There is no grass, except for a very few clumps around the mesquite in some of the depressions.

Sonoita Sand (15S)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
SONOITA AND ITS SANDY ANALOG, s, c-l Typic Haplargids	90	Avg. 60-8 and 92-3	Same as $CaC0_3$
Next two components:	10		
Bluepoint, Typic Torripsamments		68-1	68-1
Whitlock, c-l Typic Haplocalcids		60-2	60-2
Streamwash (miscellaneous area)	$<^1/_2$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in seven small areas, one east and one southeast of Tortugas Mountain and the other five north of Fort Selden. Bluepoint soils are on coppice dunes; the other soils have formed in sandy eolian sediments. Elevations range from 4,150 to 4,400 feet.

These soils occur in areas of eolian deposits on ridge crests and in slight lows in the lee of ridge crests. Slopes range from level to 5 percent.

The vegetation consists of snakeweed, creosotebush, mesquite, whitethorn, four-wing saltbush, and dropseed.

Sonoita, Hueco, and Yucca Soils (15SA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
SONOITA, c-l Typic Haplargids	35	Avg. 92-3, 60-8	92-3
Next two soils:	35		
HUECO, c-l Argic Petrocalcids		61-7	Avg. 90-2, 90-3
CRUCES, 1 Argic Petrocalcids		61-7	90-5
YUCCA, c-l Typic Calciargids	20	90-1	90-1
Bluepoint, Typic Torripsamments	10	68-1	68-1

Location, Parent Materials, Landscape, and Vegetation

These soils occur in five delineations, one east and one southeast of Tortugas Mountain and three north of Fort Selden. Most of the soils have formed in eolian sediments, but some have formed partly in alluvium derived from either rhyolite or from the Camp Rice Formation (fluvial facies). Elevations range from 4,300 to 4,400 feet.

These soils occur on ridge crests and on the lee sides of ridge crests. Slopes range from level to 5 percent. Coppice dunes occur in places.

The vegetation consists of dropseed, snakeweed, mesquite, soaptree yucca, fluffgrass, Mormon tea, creosotebush, whitethorn, bush muhly, zinnia, and sumac.

Sonoita, Dona Ana, and Bluepoint Soils (15SB)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	60		
SONOITA, c-l Typic Haplargids		Avg. 67-3, 92-3	Same as $CaC0_3$
DONA ANA, f-l Typic Calciargids		Avg. 65-5, 60-6	Same as $CaC0_3$
BLUEPOINT AND UNIVERSITY, Typic Torripsamments	25	68-1	Same as $CaC0_3$
HERBEL, c-l Typic Torriorthents	15	91-11	91-11
Streamwash (miscellaneous area)	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area north of the Dona Ana Mountains. They are on coppice dunes and in upslope areas of sediments derived from the Camp Rice Formation (fluvial facies). Elevations range from about 4,375 to 4,450 feet.

These soils occur on dunes and on fans and coalescent fan piedmonts that slope 1 to 3 percent. Coppice dunes are common, and small arroyos occur in places.

The vegetation consists mostly of mesquite, four-wing saltbush, creosotebush, soaptree yucca, bush muhly, fluffgrass, and snakeweed.

Headquarters Complex (16L)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
HEADQUARTERS, f-l Ustic Calciargids	30	60-18	60-18
CHISPA, f-l Ustic Haplocalcids	30	66-7	65-6
DONA ANA, f-l Typic Calciargids	15	65-5	65-5
Jal, f-l, c Typic Haplocalcids	10	65-6	65-6
Other inclusions:	15		
Glendale, f-s (calc) Typic Torrifluvents		60-15	60-15
Reagan, f-s Ustic Haplocalcids		60-14	60-14
Casito, l-sk, sh Argic Petrocalcids		62-1	62-1
Tencee, l-sk, c, sh Calcic Petrocalcids		62-1	62-1
Upton, l, c, sh Calcic Petrocalcids		66-5	66-5
Lacita, buried soil analog, f-s (calc) Ustic Torriorthents		92-4	92-4

Location, Parent Materials, Landscape, and Vegetation

These soils occur in several large areas east of the basin floor, on the lower piedmont slopes west of the San Andres Mountains. The soils have formed in sediments derived mainly from limestone, sandstone, siltstone, and shale, with smaller amounts of granite, andesite, quartzite, and rhyolite. Elevations range from about 4,300 to 4,500 feet.

These soils occur on the Jornada fan piedmont. Broad, gently sloping drainageways occur in places. They are as much as 0.5 mile wide and are level or nearly level transversely. The drainageways extend westward towards the basin floor. Between the drainageways are slightly higher (several meters), very gentle ridges. In many areas there are common scarps ranging from a few centimeters to nearly 1 meter in height. The scarps are commonly cut in the Organ sediments and in places penetrate the underlying soil of Jornada age. The scarps occur at intervals of several tens to several hundreds of meters. Low dunes occur above some scarps. Between the scarps, the microrelief is either one of constant slope or one that includes slight drainageways several decimeters in depth. Small drainageways are common in front of the scarps. Slopes range from 2 percent in the eastern part of the unit to 1 percent in the western part.

Areas above scarps or intermediate between scarps commonly have burrograss and tarbush with scattered clumps of tobosa. Areas of truncated soils below scarps are generally barren or have tarbush or a few creosotebushes in drainageways. There is some alkali sacaton and scattered soaptree yucca in the sandier areas. In the stablest drainageways, there are occasional thick stands of tobosa and burrograss.

Dona Ana Soils (16LS)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DONA ANA, f-l Typic Calciargids	70	65-5	65-5
Headquarters, f-l Ustic Calciargids	10	60-18	60-18
Other inclusions:	20		
Chispa, f-l Ustic Haplocalcids		Avg. 60-17, 68-7, 66-7	Same as $CaC0_3$
Jal, f -l, c Typic Haplocalcids		65-6	65-6

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area west of the San Andres Mountains and directly east of the basin floor. The soils have formed in sediments derived mainly from limestone, calcareous sandstone, and shale, with smaller amounts of granite, quartzite, andesite, and rhyolite. Elevations range from about 4,300 to 4,350 feet.

These soils occur on the lower slopes of the Jornada fan piedmont. Slopes are level or nearly level transversely. There are scattered minor drainageways but no large gullies or arroyos. Slopes are 1 percent to the west.

The vegetation is dominantly snakeweed, soaptree yucca, fluffgrass, tarbush, and occasional clumps of burrograss, tobosa, and alkali sacaton. Barren areas are common.

Dona Ana-Algerita Complex (16M)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DONA ANA, f-l Typic Calciargids	50	60-6	60-6
ALGERITA, c-l Typic Haplocalcids	20	60-6	60-6
Berino, f-l Typic Calciargids	10	Avg. 60-7, 60-13, 68-9, 70-7	Same as $CaC0_3$
Bluepoint, Typic Torripsamments	20	68-1	68-1
Streamwash (miscellaneous area)	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils occur in scattered areas east of the valley and north of the Dona Ana Mountains. They are on coppice dunes and in areas of sediments derived mainly from monzonite, with smaller amounts of andesite and rhyolite. Elevations range from about 4,300 to 4,700 feet.

These soils occur on the Jornada fan piedmont. There are a few gullies and small drainageways but no arroyos. Slopes are 1 percent over most of the area but are almost level near the basin floor.

Most of the vegetation is on dunes and consists mainly of mesquite, in places with four-wing saltbush and a few creosotebushes. Interdune areas are barren or have a few snakeweed, creosotebush, or tarbush plants.

Algerita Complex (16MA)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ALGERITA, c-l Typic Haplocalcids	45	60-6	60-6
Streamwash (miscellaneous area)	10		
Next two soils:	10		
Anthony, c-l (calc) Typic Torrifluvents		Avg. 65-3, 65-4	Same as $CaC0_3$
Delnorte, l-sk, sh Typic Petrocalcids		Avg. 61-10, 66-2	Avg. 61-10, 66-2, + 0.45% to 18 cm
Next three soils:	10		
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11
Nickel, l-sk Typic Haplocalcids		59-13	59-13
Arizo, s-sk Typic Torriorthents		Avg. 60-3, 61-6	Same as $CaC0_3$
Next seven soils:	25		
Berino, f-l Typic Calciargids		Avg. 60-7, 60-13, 68-9	Same as $CaC0_3$
Canutio, l-sk (calc) Typic Torriorthents		66-3	66-3
Dona Ana, f-l Typic Calciargids		61-4	61-4
Hachita, l-sk, sh Argic Petrocalcids		Avg. 59-16, 70-8	Same as $CaC0_3$
Simona, l, sh Typic Petrocalcids		Avg. 59-11, 60-10	Same as $CaC0_3$
Whitlock, c-l Typic Haplocalcids		60-2	60-2
Yucca, c-l Typic Calciargids		90-1	90-1

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one large area west of the central part of the Organ Mountains. The soils have formed in alluvium derived mostly from monzonite, with smaller amounts of andesite, rhyolite, and/or limestone.

These soils occur on ridges and terraces of several levels and ages. The highest ridges are Jornada I. Successively lower levels of stable or relatively stable surfaces are the Tortugas, Picacho, and Fillmore. Drainageways commonly extend from the arroyos and incise the ridges. Longitudinal slopes range from 2 to 5 percent; the transverse slopes of ridge sides range from about 5 to 35 percent.

The vegetation is commonly dominated by creosotebush, in places with some mesquite, ratany, whitethorn, and Mormon tea. On the highest ridges, generally there are only a few creosotebushes and the vegetation is mainly ratany, whitethorn, Mormon tea, and a few bush muhly and fluffgrass plants. In these areas there is much more creosotebush, along with some soaptree yucca, in the drainageways between the ridges.

Whitlock and Rilloso Soils (16MB)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	80		
WHITLOCK, c-l Typic Haplocalcids		60-2	60-2
RILLOSO, s Typic Haplocalcids		60-11	60-11
Streamwash (miscellaneous area)	5		
Other inclusions:	15		
Dona Ana, f-l Typic Calciargids		61-4	61-4
Hap, f-l Typic Calciargids		60-7	60-7
Yturbide, Typic Torripsamments		Avg. 60-3, 61-6	Same as $CaC0_3$
Typic Petrocalcids		60-10	60-10
Yucca, c-l Typic Calciargids		90-1	90-1
Herbel, c-l (calc) Typic Torriorthents		91-11	91-11

Location, Parent Materials, Landscape, and Vegetation

These soils occur downslope from Summerford Mountain. They have formed in alluvium derived primarily from monzonite. Elevations range from 4,400 to 4,700 feet.

Ridges, mostly of Jornada II age, are the dominant landform. Small arroyos and, in places, narrow Organ terraces occur between the ridges. Slopes are mostly 3 percent but range to 5 percent.

The vegetation is mostly creosotebush. In places there are also snakeweed, soaptree yucca, fluffgrass, and bush muhly.

Stellar-Continental Complex (16V)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
STELLAR, f Ustic Calciargids	50	61-3	61-3
CONTINENTAL, f Typic Calciargids	35	61-3	67-6
Berino, f-l Typic Calciargids	10	60-7	60-7
Next two soils:	5		
Dona Ana, f-l Typic Calciargids		61-4	61-4
Headquarters, f-l Ustic Calciargids		60-18	60-18
Joveatch, f Ustic Calciargids	<$^1/_2$		

Location, Parent Materials, Landscape, and Vegetation

These soils occur north of Isaacks' Lake Playa in a broad band that parallels fan toeslopes east of the Dona Ana Mountains. The soils have formed in aluvium derived from monzonite, rhyolite, and andesite. Elevation is about 4,300 feet.

These soils occur in a transition zone between the basin floor and the fan piedmont from the Dona Ana Mountains. There are no gullies or arroyos and no marked undulations in the landscape. In many places there are prominent barren strips that are along the contour and that alternate with vegetated strips. The barren strips commonly occur below small scarps that generally range from 1 to about 10 centimeters in height. Most slopes range from about $^1/_2$ percent (1 percent in small areas on the mountainward parts of the toeslopes) to nearly level next to the basin floor.

The vegetation in the vegetated areas consists primarily of tobosa and burrograss, with scattered snakeweed, soaptree yucca, and mesquite.

Dona Ana Sandy Loam (16VG)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DONA ANA, f-l Typic Calciargids	60	Avg. 61-4, 2307, 2411	Same as $CaC0_3$
Hap, f-l Typic Calciargids	10	Avg. 61-4, 2307, 2411	Same as $CaC0_3$
Tres Hermanos, f-l Typic Calciargids	10	Avg. 61-4, 2307, 2411	Same as $CaC0_3$
McAllister, f-l Ustic Calciargids	10	70-7	70-7
Next two soils:	10		
Berino, f-l Typic Calciargids		60-7	60-7
Onite, c-l Typic Haplargids		Avg. 61-5, 62-3	Same as $CaC0_3$
Streamwash (miscellaneous area)	<½		

Location, Parent Materials, Landscape, and Vegetation

These soils are in large areas east of the Dona Ana Mountains. The soils have formed in alluvium derived from rhyolite, monzonite, andesite, and latite, in a few places with minor amounts of limestone. Elevations range from about 4,300 to 4,400 feet.

These soils occur on the Jornada fan piedmont. There are scattered small drainageways up to 1 to 2 decimeters deep between shrubs and a few gullies up to about 4 decimeters deep. Thin deposits, ranging from a few centimeters to about ½ meter in thickness, are common in places, particularly along mountainward parts of the map unit. Slopes range from about 1 to 2 percent.

The vegetation consists mainly of tarbush, creosotebush, and desertthorn; scattered clumps of tobosa occur in a few places.

Reagan Clay Loam (51)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
REAGAN, f-s Ustic Haplocalcids	80	Avg. 60-17, 68-7	Same as $CaC0_3$
Reakor, f-s Typic Haplocalcids	10	60-14	Avg. 60-17, 68-7
Algerita, c-l Typic Haplocalcids	5	61-2	61-2
Chispa, f-l Ustic Haplocalcids	5	Avg. of 60-17, 68-7, 66-7	Same as $CaC0_3$

Location, Parent Materials, Landscape, and Vegetation

These soils occur northeast of Isaacks' Lake Playa. The soils have formed in nongravelly sediments with substantial amounts of silt and clay. The sediments were derived mainly from limestone, calcareous sandstone, siltstone, and shale, with smaller amounts of rhyolite, andesite, and granite. Elevation is about 4,300 feet.

These soils occur in and near a level or nearly level basin floor of Petts Tank age. The surface is generally very smooth. In places broad drainageways from the east extend westward across the map unit. Distinct barren strips are common in places; they are up to 1 meter or more wide and a few to scores of meters long. The strips occur along the contour and commonly have small scarps, ranging from several centimeters to 10 centimeters or more in height. In the level western part of the unit, the barren strips are subdued or do not occur. These soils are level in the western and lowest part of the basin floor but slope about $^1/_2$ percent to the west in the eastern part.

The vegetation consists mainly of burrograss, with scattered clumps of tobosa in a few areas and a few tarbush, sumac, and crucifixion thorn plants.

Dalby Clay, Overflow (53)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
DALBY taxadjunct, v-f Chromic Haplotorrerts	90	60-16	60-16
Inclusions:	10		
Stellar, f Ustic Calciargids		60-21	Avg. 60-21, 67-6
Joveatch, f Ustic Calciargids		61-4	60-16
Headquarters, f-l Ustic Calciargids		60-18	60-16

Location, Parent Materials, Landscape, and Vegetation

These soils occur in the central and lowest part of Isaacks' Lake Playa and in the small playa east of the New Mexico State University (NMSU) Ranch Headquarters. In Isaacks' Lake Playa, the soils have formed in a mixture of sediments derived from monzonite, rhyolite, andesite, latite, limestone, calcareous sandstone, siltstone, and shale. East of the NMSU Ranch Headquarters, the sediments were derived mainly from monzonite, rhyolite, and andesite, but some were derived from the Camp Rice Formation (fluvial facies) on the adjacent basin floor. Elevation is about 4,295 feet.

The microrelief of the southern end of Isaacks' Lake Playa is fairly smooth, except for cracks, which during the dry season range up to 5 centimeters or more in width and a meter of more in depth. Slopes are level.

The vegetation consists mainly of weeds; blueweed is dominant in Isaacks' Lake Playa.

Bucklebar Analog, Overflow (53A)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
BUCKLEBAR, Ustic analog, f-l Ustic Haplargids	30	Avg. 70-5, 60-16	Same as $CaC0_3$
Other soils:	70		
Stellar, f Ustic Calciargids		60-21	Avg. 60-21, 67-6
Dalby taxadjunct, v-f Chromic Haplotorrerts		60-16	60-16
Joveatch, f Vertic Calciargids		60-21	Avg. 60-21, 67-6
Eloma, fine analog, f Ustic Haplargids		Avg. 70-5, 60-16	Same as $CaC0_3$

Location, Parent Materials, Landscape, and Vegetation

These soils occur directly north of Isaacks' Lake Playa and on the outer, easternmost part of the playa. In the latter position, the soils have formed largely in monzonite sediments. Directly north of the playa, the soils have formed in a mixture of sediments derived from monzonite, rhyolite, andesite, limestone, calcareous sandstone, siltstone, and shale. Elevation is about 4,295 feet.

The microrelief is fairly smooth, except for the area directly north of Isaacks' Lake Playa, which in places has hummocks ranging from about 10 to 30 centimeters in height. Areas of this map unit slope very gently into the lowest part of the playa (map unit 53).

East of the playa, the vegetation is mostly vine mesquite, with some blueweed in places. Barren areas are common. Alkali sacaton occurs on some of the hummocks north of the playa.

Stellar-Continental Complex, Overflow (55)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
STELLAR, f Ustic Calciargids	55	60-21	Avg. 60-21, 90-8
CONTINENTAL, f Typic Calciargids	35	Avg. 2100, 2200	Same as $CaC0_3$
Berino, f-l Typic Calciargids		Avg. 60-7, 68-9	Same as $CaC0_3$
Reagan, f-s Ustic Haplocalcids	10	Avg. 60-7, 68-7	Same as $CaC0_3$
Joveatch, f Vertic Calciargids		Avg. 60-21, 90-7	Same as $CaC0_3$

Location, Parent Materials, Landscape, and Vegetation

These soils are north and south of Isaacks' Lake Playa. They have formed in sediments derived from monzonite, andesite, and rhyolite. Elevations range from about 4,295 to 4,320 feet.

These soils occur on the basin floor, mostly just east of the fan piedmont descending from the Dona Ana Mountains. The surface is fairly smooth, except for grass clumps and occasional small depressions. Most of the area is level or nearly level. There is slow movement of surface water towards Isaacks' Lake Playa. The soils receive runoff from the fan piedmont.

The vegetation consists primarily of a heavy stand of tobosa, with only scattered barren areas. There are a few patches of burrograss and a few soaptree yuccas.

Algerita Sandy Loam, Eroded (56)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ALGERITA, c-l Typic Haplocalcids	65	61-2	61-2
Other soils:	35		
Algerita, disc. cemented analog, c-l Typic Haplocalcids		61-1	61-1
Berino, f-l Typic Calciargids		68-6	68-6
Dona Ana, f-l Typic Calciargids		68-6	68-6
Simona, l, sh Typic Petrocalcids		61-1	61-1

Location, Parent Materials, Landscape, and Vegetation

These soils occur primarily on the basin floor north of Highway 70 and Isaacks' Lake. There is also a small area west of the northern part of the Dona Ana Mountains. The soils have formed in the sand and mixed rounded gravel of the Camp Rice Formation (fluvial facies). Elevations range from about 4,300 to 4,310 feet.

Broad ridges with little amplitude are characteristic of this map unit. Within the broad ridges are somewhat stabler, discontinuous grassy flats. These ridges are only several meters higher than the adjacent slight depressions in which soils of map unit 57 occur. In some places the boundary between the two map units is quite sharp and readily observed, but in other places it is very gradual.

The vegetation consists mostly of scattered soaptree yucca, fluffgrass, snakeweed, burrograss, tarbush, and mesquite. In places there are scattered clumps of tobosa. Barren areas are common.

Algerita Sandy Loam (57)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
ALGERITA, c-l Typic Haplocalcids	60	68-6	68-6
CHISPA, f-l Ustic Haplocalcids	25	68-6	66-7
Other soils:	15		
Berino, f-l Typic Calciargids		68-6	68-6
Dona Ana, f-l Typic Calciargids		68-6	68-6

Location, Parent Materials, Landscape, and Vegetation

These soils occur on the basin floor north of Isaacks' Lake Playa. They have formed mainly in noncalcareous sand of the Camp Rice Formation (fluvial facies); there are also a few rounded pebbles of mixed lithology. Elevation is about 4,300 feet.

These soils occur on the basin floor adjacent to the toeslopes of the fan piedmont and also occur in very slight depressions that are about 1 to several meters lower than adjacent slight ridges. The basin floor is level.

The vegetation consists mainly of burrograss; in places there are scattered tarbush and a few clumps of tobosa. There are occasional barren strips.

Tencee, Simona, and Cruces Soils (58)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
TENCEE, l-sk, c, sh Calcic Petrocalcids	45	95-4	61-10
SIMONA, l, sh Typic Petrocalcids	30	95-4	60-10
CRUCES, l, sh Argic Petrocalcids	20	95-4	61-7
Next two soils:	10		
Berino, f-l Typic Calciargids		68-2	68-2
Bucklebar, f-l Typic Haplargids		88-1	88-1
Other inclusions:	5		
Herbel, c-l (calc) Typic Torriorthents		Avg. 61-5 (0-86 cm) and 91-11 (0-99 cm)	Avg. 61-5 (0-86 cm) and 91-11 (0-85 cm)
Whitlock, c-l Typic Haplocalcids		60-2	60-2

Location, Parent Materials, Landscape, and Vegetation

These soils occur on the basin floor and an adjacent scarp east and northeast of Goat Mountain. They have formed in fluvial sediments of the Camp Rice Formation. These sediments are mostly sandy but have some pebbles of mixed composition. Elevations range from about 4,325 to 4,360 feet.

These soils occur on slight ridges on the JER La Mesa basin floor and on 1 to 2 percent slopes leading to the adjacent scarp. The ridges on the basin floor are separated by slight to broad, slightly lower areas in which soils of map unit 59 occur. The ridges are generally less than 1 meter to several meters higher than the intervening lows.

The vegetation consists of scattered creosotebush, mesquite, zinnia, and snakeweed. In places there are a few clumps of fluffgrass and/or burrograss.

Cacique and Hueco Analogs (59)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CACIQUE ANALOG, f-l Ustalfic Petrocalcids	40	95-4	60-21
HUECO ANALOG, c-l Ustalfic Petrocalcids	20	95-4	60-18
Next four soils:	25		
Cruces, l, sh Argic Petrocalcids		95-4	95-4
Rotura analog, f-l Typic Petrocalcids		95-4	65-7
Rotura, c-l Typic Petroargids		95-4	95-4
Hueco, c-l Argic Petrocalcids		95-4	95-4
Other inclusions:	15		
Berino, f-l Typic Calciargids		68-2	68-2
Bucklebar, f-l Typic Haplargids		88-1	88-1
Sonoita, c-l Typic Haplargids		72-3	72-3

Location, Parent Materials, Landscape, and Vegetation

These soils occur on the basin floor east and northeast of Goat Mountain. They have formed partly in sediments of the Camp Rice Formation (fluvial facies; mostly sand, with a few pebbles) and partly in finer textured sediments contributed by the bordering piedmont slopes and by ridges on the basin floor. Dustfall in the topographic lows has also contributed fine sediments, especially in the most densely vegetated areas. The dustfall on soils protected by a grass or grass-shrub cover would be less likely to blow away than the dustfall in barren or nearly barren areas. Elevations range from about 4,325 to 4,340 feet.

These soils occur in broad to small topographic lows on the basin floor of the JER La Mesa, in areas bordering the piedmont slope and between slight ridges. The soils are level or nearly level.

The vegetation consists mainly of grass in many places, with no shrubs or relatively few shrubs. The grass is mostly tobosa, which ranges from thick stands to scattered clumps separated by barren areas. Burrograss also occurs in many areas, especially along and near the margins of the lows. Shrubs consist mostly of a few mesquite, snakeweed, soaptree yucca, Mormon tea, and creosotebush plants in various places. In some areas, particularly in slight depressions and below contributing slopes in the western part of the unit, there is a dense cover of large shrubs or shrubs and grass.ewow.9([bs o24.2cs5la4.2cs5la(e(0 with no shr)-24.3(ubs u5go4pe(0aa0e.0039 a.Hf2l340 feet.)Tjse)

Cacique and Hueco Soils and Rotura Analog (60)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
CACIQUE, f-l Argic Petrocalcids	40	95-4	95-4
HUECO, c-l Argic Petrocalcids	25	95-4	95-4
ROTURA, fine-loamy analog, f-l Typic Petroargids	20	95-4	65-7
Inclusions:	15		
Berino, f-l Typic Calciargids		68-2	68-2
Bucklebar, f-l Typic Haplargids		88-1	88-1
Sonoita, c-l Typic Haplargids		72-3	72-3

Location, Parent Materials, Landscape, and Vegetation

These soils occur in one area east of Goat Mountain. They have formed mainly in noncalcareous sand (with a few rounded pebbles) of the Camp Rice Formation (fluvial facies). Elevation is about 4,340 feet.

These soils occur on the JER La Mesa surface, a nearly level relict basin floor. The landscape is undissected, and there are no arroyos or gullies. The surface is very gently undulating, with occasional slight depressions.

Mesquite is the dominant vegetation, with scattered creosotebush and zinnia in places. Generally, the soil surface is smooth and barren between shrubs. The depressions include small areas dominated by large mesquite and larger depressions with relatively dense mesquite, creosotebush, and snakeweed, with occasional soaptree yucca, zinnia, bush muhly, and dropseed.

Torripsamments, Torriorthents, Haplocalcids, and Rocky Areas (40B)

Map Unit Composition and Carbon Source

Soil name and classification	Percent of map unit	Source of $CaCO_3$	Source of organic C
First two soils:	70		
TORRIPSAMMENTS		Avg. 59-10, 59-17, 93-1, 93-2	Same as $CaC0_3$
TORRIORTHENTS		Avg. 59-10, 59-17, 93-1, 93-2	Same as $CaC0_3$
Next two soils:	25		
Haplocalcids		Avg. 60-11, 60-7, 62-3	Same as $CaC0_3$
Haplargids		Avg. 60-11, 60-7, 62-3	Same as $CaC0_3$
Rock outcrop	5		

Location, Parent Materials, Landscape, and Vegetation

These soils occur west of Picacho Mountain and northwest of Goat Mountain. The soils are in dissected areas of variably cemented materials. Where noncemented, the materials range from sand to clay. Elevations range from about 4,250 to 4,400 feet.

The materials have been variably dissected, and the landscape consists of ridges that range from slight to prominent. Most slopes range from about 5 to 60 percent, and there are some vertical scarps.

The vegetation generally consists of mesquite, creosotebush, snakeweed, and fluffgrass. Some areas are barren.

Map Units 40L, 40M, 40R, and 40V

Map units 40L, 40M, 40R, and 40V are dominated by bedrock and were not included in the carbon calculations. For a general description of these four map units, see Gile and Grossman (1979, p. 701-704).

Additions to the Soil Map

As additional information becomes available, it is added to the soil maps to keep them current. Three general kinds of additions have been made since the maps were reproduced in 1993. One of these involves the location of sampled pedons 96-1, 96-2, 96-3, 88-2, 66-9, 66-10, and 59-9. (See the pedon descriptions in the Appendix of this volume and *The Desert Project Soil Monograph*, for the location of these pedons.) Another addition involves a delineation of map unit 10MLO along Baylor Canyon Road. The third addition consists of four new map units (13MD, 58, 59, and 60; tables 5 and 6). Unit 13MD shows the effects of facies changes in soils of Isaacks' Ranch age. It also illustrates initial development of the calcic horizon and the Yucca series. Units 58, 59, and 60 illustrate classic shifts from carbonate stages III to V and the relation of these shifts to landscape position and texture. The second and third additions are shown on the detailed soil map at a reduced scale (sheet 7, which is on the CD that accompanies this publication and is included in printed form with the 28 soil maps at the back of this publication).

Discussion

Although the Desert Project closed in 1972, there is still considerable interest in these investigations. This interest is shown by a number of study tours held in the Desert Project since it closed. The most recent of these (in May 2000) was attended by 100 participants (attendance was limited to 100 because of logistical problems in handling larger groups).

Several factors combine to make the Desert Project ideal for illustrating soils and soil-geomorphic principles in arid and semiarid regions. Within a relatively small and accessible area, the Desert Project has a river valley, a valley border with soils of varying ages and degrees of dissection, mountain ranges that vary considerably in their lithology and contributions to soil parent materials downslope, mountains with more precipitation than the basins between them, both relict and active basin floors, and soils that range in age from a few to $2^1/_2$ million years. In addition, continuing soil-geomorphic and closely associated geologic research (as shown by the literature cited) keeps research in the area up-to-date. Studies by Connin et al. (1997a, b), Monger et al. (1998), and Monger and Gallegos (2000) provide information on carbon isotopes, biotic and abiotic processes of carbonate accumulation, and carbon sequestration.

The Desert Project is strategically located with respect to important long-term research organizations concerning arid and semiarid lands—the Jornada Experimental Range (fig. 1), the Chihuahuan Desert Rangeland Research Center (fig. 1), and the closely associated Jornada Basin Long-Term Ecological Research Program. Cooperation with these groups began shortly after the Desert Project began in 1957 and continues to the present.

Because of these research organizations and the associated public domain (controlled by the State and Federal governments, such as WSMR and WSTF), many of the detailed study sites in and near the Desert Project can be permanently preserved. Thus, the Desert Project could be available as a study and training ground for future generations.

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Appendix: Laboratory Data and Descriptions of Sampled Pedons

Analyses for soils sampled from 1957 to 1972 are in *The Desert Project Soil Monograph* (Gile and Grossman, 1979). Soils sampled since 1972 are listed below. Numbers given for the sampled pedons are abbreviations for the sampling numbers. For example, sampling number S88NM-013-001 is abbreviated 88-1; the first two numbers refer to the year of sampling, and the third, the order in which the soils were sampled. The same chronological order is followed in the data and description sheets in this Appendix. Data and descriptions for the pedons listed below are in this Appendix, except for pedons sampled in 1987 and 1988 (see Gile et al., 1995b) and for pedons 90-1, -2,-3, -4, -5, -6, -7, and -8 (see Herbel et al., 1994).

Table 8 identifies and locates the laboratory data analyzed by the National Soil Survey Laboratory (NSSL), and table 9 identifies and locates the laboratory data not analyzed by the NSSL. Tables 10 to 15 give further information about the pedons.

Table 8. —Pedon numbers, names, and location of laboratory data and descriptions of soils analyzed by the NSSL*

Pedon number	Series, analog, or phase	Page
[1] 90-9	Bluepoint	244
[1] 90-10	Rilloso	247
[2] 90-100	Yucca	250
[2] 90-101	Yucca	253
[3] 91-10	Reagan	258
91-11	Herbel	266
[2] 92-1	Bluepoint	269
[2] 92-2	Amole	272
[4] 92-3	Sonoita	275
92-4	Lacita, buried soil analog	278
92-5	Reagan	281
93-1	University	284
93-2	University	287
[5] 94-1	Cruces, overblown phase	289
[5] 94-2	Bluepoint	296
[5] 94-3	Sonoita, sandy analog	299
[5] 94-4	Yucca, deep argillic analog	304
[6] 95-1	SND #3	308
95-2	Yucca, deep analog	313
[6] 95-3	Yucca, calcareous analog	322
95-4	Hueco	330
[7] 96-1	Tres Hermanos, overwash phase	345
[7] 96-2	Dona Ana	350
[7] 96-3	Delnorte	356
99-1	Yucca	359

* Footnotes identify publications in which some of the data were used: 1, Gile, 1993; 2, Gile, 1995; 3, Gile et al., 1995a; 4, Gile, 1994b; 5, Gile et al., 1997; 6, Gile, 1999; 7, Gile et al., 1998.

Table 9. —Pedon numbers, names, and location of laboratory data other than those determined by the NSSL [1]

Pedon number	Series	Page
KL-82-1	Summerford	238
OMF-I	Baylor	239
OMF-2	Holliday	240
OMF-3	Holliday	240
OMF-4	Holliday	240
OMF-6	Baylor	239
OMF-33	Earp	239
OMF-B	Earp	239
T-1100	Onite	241
T-1200	Onite	241
T-1303	Onite	241
T-2100	Continental	242
T-2200	Continental	242
T-2307	Dona Ana	242
T-2411	Dona Ana	242
HCM	Rotura	243

[1] KL-82-1, personal communication, Kate Lajtha, 1986 (table 10); T-1100, T-1200, T-1303, T-2100, T-2200, T-2307, and T-2411 (Tatarko, 1980, tables 13 and 14); OMF-1, OMF-2, OMF-3,OMF - 4, OMF-6, OMF-33, and OMF-B (Gile, 1994a, tables 11 and 12); and HCM (Monger et al., 1991, table 15).

Table 10.—Laboratory data for pedon KL-82-1, the Summerford series, an Ustic Haplargid on the Chihuahuan Desert Rangeland Research Center [1]

Organic carbon (from first sampling, by arbitrary depth limits)

Depth (cm)	Organic C
0-8	0.524
8-20	0.587
20-30	0.343
30-45	0.288
45-60	0.107

Carbonate (from second sampling, by horizons) and particle-size analysis

Depth (cm)				
58-67	---	78	13	9
67-84	0.66	78	15	8
84-107	1.26	79	15	6
107-131	1.37	76	14	10

[1] Personal communication, Kate Lajtha, 1986.

Table 11.—Characteristics of Mollisols at the Organ Mountains fault study area (Gile, 1994a)

(Abbreviations for textural class are g, gravelly; vg, very gravelly; vc, very cobbly; vst, very stony; ls, loamy sand; sl, sandy loam; s, sand; l, loam; scl, sandy clay loam; c, clay; and cl, clay loam. Horizons and rock fragments not noted at the Beehner site (the soil is skeletal). All soils are noncalcareous throughout, except for the lower three horizons of OMF-33, which contain in the order of several percent $CaCO_3$.)

Horizon	Depth	Sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Particle size	Organic C
	cm	%	%	%		%
OMF-1. —Torriorthentic Haplustoll (Baylor) at site 1:						
A1	0-7	77	16	7	vcls	1.28
A2	7-18	77	15	8	vcsl	1.17
A3	18-30	80	14	6	vcls	0.73
	30-42	82	11	7	vcls	0.73
A4	42-55	82	14	5	vcls	0.55
A5	55-68	88	8	5	vcls	0.45
CA1	68-85	91	7	3	vcs	0.30
CA2	85-113	95	5	1	vcs	0.12
C	113-119	93	5	2	vcs	0.06
OMF-6. —Torriorthentic Haplustoll (Baylor) at site 6:						
A1	0-5	75	17	8	sl	0.69
A2	5-22	78	14	8	ls	0.61
2A3	22-48	78	14	8	vcls	0.49
2A4	48-72	83	10	7	vcls	0.35
2CA	72-107	90	6	5	vcs	0.23
2C	107-140	91	5	4	vcs	0.06
OMF-33. —Aridic Argiustoll (Earp) at site 33:						
A	0-10	71	16	13	vcsl	0.70
BAt	10-35	62	17	21	vcscl	0.74
Blt	35-56	67	10	23	vcscl	
Bt2	56-77	67	8	25	vcscl	
Bt3	77-110	64	11	25	vcScl	
Btk	110-141	72	7	21	vcscl	
BCtk1	141-172				vstsl	
BCtk2	172-210				vstls	
OMF-B.—Aridic Argiustoll (Earp) at Beehner site:						
	0-6	77.0	16.5	6.5	ls	1.20
	6-14	74.0	18.0	8.0	sl	1.57
	14-28	74.0	15.5	10.5	sl	0.74
	28-46	70.0	17.5	12.5	sl	
	46-63	73.0	14.0	13.0	sl	
	63-87	70.0	17.0	13.0	sl	
	87-115	70.0	16.0	14.0	sl	
	115-155	73.0	14.0	13.0	sl	
	155-187	80.0	10.5	9.5	ls	
	187-218	78.5	11.5	10.0	sl	
	218-260	80.5	11.0	8.5	ls	
	260-296	88.0	6.5	5.5	s	

Table 12.—Characteristics of the Ustic Haplargids, Holliday soils, at the Organ Mountains fault study area (Gile, 1994a)

(The soils are noncalcareous throughout.)

Horizon	Depth	Sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Particle size	Organic C
	cm	%	%	%		%
OMF-2, site 2:						
A	0-5	76	16	8	sl	0.73
Bt1	5-21	76	14	10	sl	0.54
2Bt2	21-37	74	16	11	vcsl	0.48
2Bt3	37-54	76	13	12	vcsl	0.41
2Bt4	54-84	75	14	11	vcsl	0.39
2BCt1	84-130	78	12	10	vcsl	0.26
2BCt2	130-179	80	12	8	vcsl	0.17
2C	179-210	90	5	5	vcs	0.07
OMF-3, site 3:						
A	0-5	78	14	8	ls	0.53
Bt1	5-26	74	16	10	sl	0.48
Bt2	26-40	75	14	11	sl	0.50
2Bt3	40-70	75	15	10	vcsl	0.46
2Bt4	70-112	80	10	10	vcls	0.28
2CBt1	112-137	86	8	6	vcls	0.14
2CBt2	137-162	89	5	6	vcs	0.13
2C	162-192	88	6	6	vcs	0.12
OMP-4, site 4:						
A	0-4	78	12	10	sl	0.52
Bt1	4-26	72	18	10	sl	0.46
2Btl	26-51	69	17	14	vcsl	0.42
2Bt3	51-76	68	20	12	vcsl	0.39
2Bt4	76-104	75	15	10	vcsl	0.25
2BCt1	104-140	74	17	8	vcs1	0.19
2BCt2	140-178	80	13	7	vcls	0.14
2C	178-198	91	5	4	vcs	0.07

Table 13.—Characteristics of the Typic Haplargids, Onite soils, at the Tatarko study sites (Tatarko, 1980)

Horizon[1]	Depth	Sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Particle size	> 2 mm vol.	$CaCO_3$	Organic C
	cm	%	%	%		%	%	%
T-1100:								
A1	0-5	77.5	17.9	4.6	ls	5	0.1	0.2
B21t	5-20	73.3	18.0	8.7	sl	10	0.3	0.3
B22t	20-33	72.1	19.3	8.6	g sl	20	0.2	0.2
IIB3ca	33-44	73.9	18.5	7.6	vg sl	45	0.3	
IIC1ca	44-60	75.5	17.9	6.6	vg sl	50	0.5	
IIC2ca	60-89	84.9	12.5	2.6	vg ls	70	1.3	
IIC3ca	89-127	87.1	9.3	3.6	vg ls	70	0.5	
IIIC4ca	127-170	46.2	38.1	15.7	l	5	0.7	
T-1200:								
A1	0-5	83.5	14.5	2.0	ls	5	T	0.2
B21t	5-14	81.0	15.0	4.0	ls	10	T	0.2
B22t	14-28	75.1	17.8	7.1	sl	10	0.3	0.3
B3t	28-36	76.0	16.9	7.1	sl	15	0.5	
IIC1ca	36-53	67.6	23.3	9.1	g sl	30	3.9	
IIC2ca	53-86	73.3	19.7	7.0	vg sl	50	3.8	
IIC3ca	86-102	75.8	18.2	6.0	vg sl	40	2.2	
IIIC4ca	102-126	74.6	19.4	6.0	g sl	15	1.7	
IIIC5ca	126-135	71.3	22.7	6.0	sl	10	1.2	
T1303:								
A1	0-6	78.4	14.4	7.2	ls	5	0.2	0.4
B21t	6-16	70.2	16.3	13.5	sl	10	0.3	0.3
B22t	16-28	67.5	18.0	14.5	g sl	25	0.4	0.3
B3ca	28-41	66.5	22.0	11.5	g sl	25	1.0	
IIC1ca	41-60	62.4	25.1	12.5	vg sl	50	4.6	
IIC2ca	60-72	56.8	31.7	11.5	g sl	15	3.5	
IIC3ca	72-120	46.3	42.2	11.5	l		2.8	
IIIC4ca	120-153	45.4	33.0	21.6	l	10	1.9	

[1] Arabic, instead of Roman, numerals are now used to indicate discontinuities, and k replaces ca to indicate accumulations of carbonate (Soil Survey Division Staff, 1993).

Table 14. —Characteristics of Typic Calciargids at the Tatarko study sites (Tatarko, 1980)

Horizon[1]	Depth	Sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Particle size	> 2 mm vol.	$CaCO_3$	Organic C
	cm	%	%	%		%	%	%
T-2100, Continental:								
A1	0-7	56.8	17.4	25.8	scl		0.7	0.4
B21t	7-22	52.8	13.1	34.1	scl		1.5	0.5
B22t	22-48	42.4	18.7	38.9	cl		4.3	
B23tca	48-65	32.4	18.0	49.6	c		9.7	
B24tca	65-103	31.0	22.1	46.9	c		27.6	
B2tcab	103-127	33.7	23.2	43.1	c		10.9	
T-2200, Continental:								
A1	0-8	68.3	19.6	12.1	sl		1.4	0.5
B1	8-19	59.9	14.8	25.3	scl		1.2	0.6
B21t	19-45	49.8	14.5	35.7	sc		3.9	0.4
B22tca	45-57	36.0	19.0	45.0	c		6.8	
C1ca	57-75	24.0	21.1	54.9	c		45.6	
C2ca	75-97	28.9	21.5	49.6	c		30.5	
B21b1	97-123	38.3	29.0	32.7	cl		17.4	0.1
B22b1	123-149	32.3	31.8	35.9	cl		14.0	0.1
T-2307, Dona Ana:								
A1	0-6	75.1	9.7	15.2	sl		1.2	0.3
B1	6-15	73.9	9.9	16.2	sl		0.9	0.3
B21t	15-46	59.8	14.7	25.5	scl	5	5.1	0.4
B22tca	46-61	44.6	15.6	39.8	cl	5	10.4	
C1ca	61-110	47.5	14.9	37.6	sc	10	28.9	
C2ca	110-155	66.8	18.1	15.1	g sl	20	24.3	
T-2411, Dona Ana:								
A1	0-6	79.3	9.3	11.4	sl		1.7	0.2
B2t	6-28	70.5	13.3	16.2	sl		5.0	0.3
IIB31t	28-40	60.1	13.9	26.0	scl	40	10.1	0.4
IIIB32t	40-49	52.7	18.8	28.5	scl		17.3	
IIIB33t	49-63	50.4	17.5	32.1	scl		24.5	
IIIC1ca	63-94	51.7	17.2	31.1	scl	10	24.1	
IVC2ca	94-129	63.3	15.5	21.2	g scl	30	19.5	
IVC3ca	129-155	75.0	11.6	13.4	vg sl	40	13.9	
IVB2tcab	155-173	62.3	11.7	26.0	vg scl	45	10.0	

[1] Arabic, instead of Roman, numerals, are now used to indicate discontinuities, and k replaces ca to indicate accumulations of carbonate (Soil Survey Division Staff, 1993).

Table 15.—Characteristics of the Typic Petroargid, Rotura (Monger et al., 1991)

Horizon†		Depth	PSD Sand	Silt	Clay	pH	$CaC0_3$	Zones of carbonate morphology Zone no.	Carbonate morphology
		cm	wt. %			1/1	wt. %		
A‡	A	0-5	86.5	8.0	5.5	8.2	1.1		
Bk1	Bk1	5-16	89.0	4.9	6.1	8.1	1.9		
Bk2	Bk2	16-28	87.1	5.7	7.2	8.0	3.7	1	Stage I filaments
Bk3	Bk3	28-37	84.1	5.4	10.5	8.3	6.1		
Bk4	Bk4	37-50	80.2	6.6	13.2	8.0	8.8	2	Stage II nodules and pore hypo-coatings
Btk1	Btk1	50-61	81.6	3.9	14.5	7.8	8.4		
Btk2	Btk2	61-78	81.7	3.8	14.5	8.2	10.3		
K11t§	Btk3	78-100	83.4	4.6	12.0	8.6	9.5		
K12t	Btk4	100-113	84.4	6.1	9.5	8.4	10.0	3	Stage II and III nodules and internodular fillings
K13t	Btk5	113-120	85.0	9.3	5.7	8.3	24.0		
K21m	Bkm1	120-136	77.7	14.7	7.6	8.4	45.6	4	Stage IV laminar zone
K22m	Bkm2	136-153	75.4	14.2	10.4	8.5	41.1		
K23m	Bkm3	153-175	77.0	13.0	10.0	8.2	35.9	5	Stage IV plugged horizon
K31t¶	B´tk1	175-203	84.3	8.8	6.9	8.6	24.3		
K32t	B´tk2	203-225	83.2	9.7	7.1	8.7	29.5		
K33t	B´tk3	225-255	86.6	9.7	3.7	8.6	22.5	6	Stage III massive and nodular
K34t	B´tk4	255-272	89.2	8.0	2.8	8.8	12.7		
K35t	B´tk5	272-294	92.4	6.3	1.3.	8.8	9.8		
K36	B´k1	294-313	92.9	6.1	1.0	8.9	8.8		
K37	B´k2	313-330	94.2	4.9	0.9	9.0	9.2	7	Stage II massive and nodular
Ck#	Ck	330-348	96.8	2.7	0.5	9.4	3.1		
C1	C1	348-362	99.1	0.8	0.1	9.5	0.2		
C2	C2	362-382	99.0	0.9	0.1	9.6	0.4		
C´k	C´k	382-389	98.2	1.4	0.4	9.6	1.3	8	Stage I pebble coatings
C	C	389-430	99.2	0.7	0.1	9.6	0.0		
C´´k	C´´k	430-450+	98.6	1.2	0.2	9.6	1.0		

† Two sets of horizons are indicated for purposes of comparison. The first set contains the K horizon nomenclature of Gile et al. (1966), except that the letter t has been added to designate the presence of argillans. K2 and K2m horizons contain at least 90 percent K-fabric; the transitional K1 and K3 horizons contain at least 50 percent K-fabric. The second set of horizons is according to Guthrie and Witty (1982).

‡ The A horizon was sampled 3 m north of the profile because it was disturbed by excavation.

§ Argillans in the K1t horizon occur as reddish brown volumes, with little or no macroscopic carbonate, that are preserved between the volumes of K-fabric, in which carbonate occurs as an essentially continuous medium. The argillans consist of coatings of oriented clay on sand grains, which are typical of Bt horizons in the Desert Project area (Gile and Grossman, 1968).

¶ Argillans are sparse in the K3 horizon as a whole. Laterally, the K3t grades into K3 material without argillans and with 100 percent K-fabric.

Some subhorizons of the C horizon have pedogenic calcite in the form of pebble coatings and vertical tubes. The C horizon is dominated by geologic structure consisting of sedimentary strata deposited by the ancestral Rio Grande.

Soil series: Bluepoint
Classification: Mixed, thermic Typic Torripsamment
Soil survey number: S90NM-013-009
Location: In unsectioned Dona Ana Bend Colony, a road cut on east side of Telshor Blvd.; now commercially developed at 2200 N. Telshor Blvd., 6 m south of pedon 90-10
Elevation: 4,080 feet, 1,244 m
Landform: Crest of ridge cut off by a road cut; nearly level
Geomorphic surface: Leasburg
Parent material: Leasburg fan alluvium derived from sand and gravel of mixed composition
Vegetation: Creosotebush, scattered clumps of dropseed and bush muhly
Described and sampled by: L.H. Gile
Date: January 29, 1989

C1—0 to 13 cm; pinkish gray to light brown (7.5YR 6.5/3) fine sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; stratified; generally weakly effervescent, noncalcareous in a few parts; abrupt smooth boundary.

C2—13 to 23 cm; pinkish gray to light brown (7.5YR 6.5/3) sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; stratified; generally weakly effervescent, noncalcareous in a few parts; abrupt smooth boundary.

Akb—23 to 34 cm; pinkish gray to light brown (7.5YR 6.5/3) loamy fine sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; a few pebbles with thin, discontinuous carbonate coatings; strongly effervescent; clear wavy boundary.

BAkb—34 to 43 cm; pinkish gray to light brown (7.5YR 6.5/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; thin carbonate coatings on pebbles; some of the coatings are continuous; strongly effervescent; clear wavy boundary.

Bk1b—43 to 68 cm; pinkish gray to light brown (7.5YR 6.5/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Bk2b—68 to 92 cm; pinkish gray to light brown (7.5YR 6.5/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; few fine roots; thin, mostly continuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Btk1b2—92 to 106 cm; pinkish gray to light brown (6.5YR 6.5/3) loamy sand, brown (6.5YR 5/3) moist; a lesser amount 6YR 6/4, dry; massive; soft, except for 6YR 6/4 parts, which are slightly hard; very friable; very few fine roots; sand grains in light reddish brown parts coated with oriented clay; a few soft zones of K-fabric, of irregular shape and ranging from about 1/2 to 1 1/2 cm in diameter; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Btk2b2—106 to 119 cm; pinkish gray to light brown (6.5YR 6/3) loamy sand, brown to dark brown (6.5YR 4.5/3) moist; a lesser amount 6YR 6/4; massive; soft, except for 6YR 6/4 parts, which are slightly hard; very friable; very few fine roots; sand grains in light reddish brown parts coated with oriented clay; a few soft zones of K-fabric, of irregular shape and ranging from about 1/2 to 1 1/2 cm in diameter; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Btk3b2—119 to 143 cm; pinkish gray to light brown (7.5YR 6.5/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; very few fine roots; this horizon generally lacks the Bt material with 4 chroma but is slightly redder than the horizons beneath; a few soft, irregularly shaped zones of K-fabric, slightly whiter than the adjacent material and ranging from about 1/2 to 2 cm in diameter; strongly effervescent; clear wavy boundary.

Bk1b2—143 to 162 cm; pinkish gray to pink (7.5YR 7/3) sand, brown (7.5YR 5/3) moist; massive; soft, very friable; no roots; scattered fine pebbles, more than in adjacent horizons; thin, discontinuous carbonate coatings on some pebbles; strongly effervescent; abrupt wavy boundary.

Bk2b2—162 to 172 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5.5/3) moist; massive; soft, very friable; no roots; a few irregularly shaped, faint or distinct zones of K-fabric that are roughly circular to elliptical and range from about 2 mm to 1 1/2 cm in diameter; strongly effervescent; clear wavy boundary.

Ckb2—172 to 190 cm; pinkish gray to light brown (7.5YR 6.5/3.5) sand, brown (7.5YR 5/3.5) moist; massive; soft, very friable; no roots; thin, discontinuous carbonate coatings on pebbles; strongly effervescent.

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-009 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 90P 78, (CP90NM128) DONA ANA CO.
- PEDON 90P 500, SAMPLES 90P 2797-2808
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -		- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
90P2797S	0- 13	C1	1.7	5.6	92.7			0.8	4.8	20.3	49.9	20.5	1.8	0.2	--	--	--	72	--
90P2798S	13- 23	C2	1.9	6.4	91.7			1.9	4.5	18.6	45.9	23.3	3.5	0.4	TR	1	--	73	1
90P2799S	23- 34	Akb	3.1	10.4	86.5		0.9	2.6	7.8	20.5	41.6	19.6	4.0	0.8	1	3	--	67	4
90P2800S	34- 43	BAkb	3.7	11.7	84.6		0.6	3.6	8.1	20.5	37.5	19.7	5.6	1.3	2	6	--	67	8
90P2801S	43- 68	Bk1b	4.2	13.7	82.1		1.5	4.9	8.8	20.6	34.4	19.1	6.2	1.8	2	2	--	63	4
90P2802S	68- 92	Bk2b	4.0	14.4	81.6		1.5	4.6	9.8	19.3	35.4	19.5	6.2	1.2	2	2	--	64	4
90P2803S	92-106	Btk1b2	5.2	11.0	83.8			2.7	8.3	17.2	36.7	21.9	6.6	1.4	1	TR	1	67	2
90P2804S	106-119	Btk2b2	6.0	11.3	82.7		0.6	3.3	8.0	18.1	33.2	22.1	7.4	1.9	2	1	--	66	3
90P2805S	119-143	Btk3b2	3.9	9.7	86.4		0.6	3.0	6.7	15.0	32.4	27.3	9.2	2.5	2	1	--	72	3
90P2806S	143-162	Bk1b2	2.1	8.7	89.2			1.6	7.1	12.5	32.3	28.2	11.2	5.0	3	1	--	78	4
90P2807S	162-172	Bk2b2	2.9	12.8	84.3			2.6	10.2	16.7	40.0	22.0	4.8	0.8	1	1	--	68	2
90P2808S	172-190	Ckb2	4.3	7.0	88.7		1.2	1.3	5.7	18.4	37.4	25.0	6.9	1.0	1	TR	--	71	1

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT	- -)			WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3a	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 13	0.17							2.88	1.24										2.1	
13- 23	0.16							2.58	1.00										1.9	
23- 34	0.22							2.00	0.87										2.7	
34- 43	0.22							1.51	0.92										3.4	
43- 68	0.17							1.29	0.93										3.9	
68- 92	0.09							1.38	0.85										3.4	
92-106	0.06							1.08	0.62										3.2	
106-119	0.06							1.10	0.55										3.3	
119-143	0.02							1.38	0.79										3.1	
143-162	0.02							2.29	1.19										2.5	
162-172	0.02							1.90	0.97										2.8	
172-190	0.02							1.30	0.63										2.7	

AVERAGES, DEPTH 25-100: PCT CLAY 3 PCT .1-75MM 65

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-009 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 90P 500, SAMPLE 90P 2797-2808

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 13	14.0	0.7	--	0.5	15.2	--		15.2	4.9	TR		100	100	TR					7.0	8.2
13- 23	10.4	0.7	--	0.4	11.5	--		11.5	4.9	TR		100	100	TR					7.7	8.3
23- 34		1.1	--	0.4					6.2	TR		100	100	1					7.7	8.5
34- 43		1.2	0.1	0.3					5.6	1		100	100	3					7.7	8.3
43- 68		1.3	0.1	0.2					5.4	2		100	100	5					7.8	8.2
68- 92		2.3	0.2	0.2					5.5	3		100	100	4					7.7	8.4
92-106		2.8	0.3	0.2					5.6	5		100	100	2					7.8	8.3
106-119		3.3	0.4	0.2					6.6	7		100	100	2					7.8	8.3
119-143		2.6	0.6	0.2					5.4	12		100	100	2					7.9	8.6
143-162		2.4	0.8	0.1					4.8	18		100	100	1					7.9	8.9
162-172		3.1	1.3	0.2					5.5	19	13	100	100	3				8.6	8.0	9.1
172-190		3.0	2.0	0.2					5.6	32	8	100	100	1				8.6	8.1	9.0

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 13																		0.13
13- 23																		0.12
23- 34																		0.12
34- 43																		0.13
43- 68																		0.14
68- 92																		0.16
92-106																		0.21
106-119																		0.24
119-143																		0.22
143-162																		0.22
162-172	0.5	0.3	8.3	0.2	--	2.7	0.5	4.0				2.2	0.3	0.4	31.3	TR	1.02	0.32
172-190	0.8	0.4	6.1	TR	--	2.4	0.4	0.7				3.9	0.2	0.1	31.1	TR	0.79	0.45

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ANALYSES: S=ALL ON SIEVED <2mm BASIS

Soil series: Rilloso

Classification: Sandy, mixed, thermic Typic Haplocalcid

Soil survey number: S90NM-013-010

Location: In the unsectioned Dona Ana Bend Colony, a road cut on east side of Telshor Blvd.; now commercially developed at 2200 N. Telshor Blvd., 6 m north of pedon 90-9

Elevation: 4,080 feet, 1,244 m

Landform: Ridge side sloping 5 percent to the north; ridge cut off by a road cut

Geomorphic surface: Leasburg

Parent material: Leasburg fan alluvium derived from sand and gravel of mixed composition

Vegetation: Creosotebush, scattered clumps of dropseed and bush muhly

Described and sampled by: L.H. Gile

Date: January 29, 1989

A—0 to 8 cm; pinkish gray (8YR 6.5/2) loamy fine sand, brown (8YR 4.5/3) moist; massive; soft, very friable; few fine roots; strongly effervescent; clear wavy boundary.

BAk—8 to 20 cm; pinkish gray to pink (8YR 7/3) loamy fine sand, brown (8YR 5/3) moist; massive; soft, very friable; few fine roots; thin, continuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Bk—20 to 31 cm; pinkish gray to pink (8YR 7/3) loamy fine sand, brown (8YR 5/3) moist; massive; soft, very friable; few fine roots; thin, continuous carbonate coatings on pebbles; strongly effervescent; abrupt wavy boundary.

K2—31 to 46 cm; pinkish white (7.5YR 8/2) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount of pinkish gray to pink (7.5YR 7/3); moderate medium subangular blocky structure and massive; carbonate nodules very hard, firm; internodular material soft, very friable; few fine roots; K-fabric occurring as carbonate nodules; strongly effervescent; clear wavy boundary.

K3—46 to 64 cm; pinkish white (7.5YR 8/2) loamy fine sand, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount of pinkish gray to pink (7.5YR 7/3); weak medium subangular blocky structure and massive; carbonate nodules very hard, firm; internodular material soft, very friable; few fine roots; K-fabric occurring as carbonate nodules; strongly effervescent; clear wavy boundary.

Btk1—64 to 74 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/4) moist; massive; soft and slightly hard, very friable; very few fine roots; few parts are light brown (6.5YR 6/4) and have sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; very few fine carbonate nodules; strongly effervescent; clear wavy boundary.

Btk2—74 to 82 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft and slightly hard, very friable; very few fine roots; few parts are light brown (6.5YR 6/4) and have sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; very few fine carbonate nodules; strongly effervescent; clear wavy boundary.

Btk3—82 to 95 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft and slightly hard, very friable; very few fine roots; few parts are light brown (6.5YR 6/4) and have sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; very few fine carbonate nodules; strongly effervescent; clear wavy boundary.

Bk1—95 to 107 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; no roots; thin, discontinuous carbonate coatings on pebbles; very few fine carbonate nodules; strongly effervescent; clear wavy boundary.

Bk2—107 to 115 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; no roots; thin, discontinuous carbonate coatings on pebbles; very few fine carbonate nodules; strongly effervescent; clear wavy boundary.

Ck—115 to 125 cm; pinkish gray to pink (8YR 7/3) loamy sand, brown (7.5YR 5/3) moist; massive; soft, very friable; no roots; slightly effervescent.

Soil series: Rilloso. Classification: Sandy, mixed, thermic Typic Haplocalcid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

90NM-013-010 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 90P 78, (CP90NM128) DONA ANA CO.
- PEDON 90P 501, SAMPLES 90P 2809-2819
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
90P2809S	0- 8	A	4.3	11.6	84.1		0.6	4.1	7.5	20.2	40.0	18.4	4.3	1.2	TR	3	--	65	3
90P2810S	8- 20	BAk	4.7	12.9	82.4		0.9	4.5	8.4	19.8	39.0	18.5	4.2	0.9	1	2	--	64	3
90P2811S	20- 31	Bk	5.9	15.1	79.0		2.4	6.1	9.0	21.2	34.3	16.9	4.9	1.7	2	3	--	60	5
90P2812S	31- 46	K2	7.3	16.0	76.7		2.4	7.5	8.5	24.0	30.0	16.6	5.2	0.9	1	1	--	54	2
90P2813S	46- 64	K3	6.0	15.5	78.5		2.7	6.4	9.1	21.1	32.5	17.7	6.0	1.2	1	1	--	58	2
90P2814S	64- 74	Btk1	6.5	11.7	81.8		1.2	4.2	7.5	17.6	34.1	21.2	7.6	1.3	1	1	--	65	2
90P2815S	74- 82	Btk2	6.9	11.5	81.6		2.4	4.9	6.6	14.5	28.9	24.2	9.9	4.1	2	2	--	68	4
90P2816S	82- 95	Btk3	5.7	11.0	83.3		0.9	4.0	7.0	19.5	31.5	21.9	7.9	2.5	2	1	--	65	3
90P2817S	95-107	Bk1	5.1	9.2	85.7		1.2	3.1	6.1	15.1	35.1	23.9	9.0	2.6	2	2	TR	72	4
90P2818S	107-115	Bk2	4.5	8.6	86.9		0.9	2.6	6.0	14.1	35.3	27.1	8.2	2.2	1	1	--	73	2
90P2819S	115-125	Ck	4.6	8.7	86.7		2.1	1.4	7.3	18.8	38.3	22.9	5.3	1.4	1	1	--	69	2

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3a	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 8	0.19							1.40	0.81										3.5	
8- 20	0.19							1.28	0.81										3.8	
20- 31	0.19							0.98	0.81										4.8	
31- 46	0.14							0.84	0.67										4.9	
46- 64	0.13							1.05	0.78										4.7	
64- 74	0.09							0.98	0.58										3.8	
74- 82	0.12							0.88	0.62										4.3	
82- 95	0.06							1.12	0.61										3.5	
95-107	0.03							0.92	0.59										3.0	
107-115	0.02							1.00	0.62										2.8	
115-125	0.02							1.09	0.59										2.7	

AVERAGES, DEPTH 25-100: PCT CLAY 4 PCT .1-75MM 61

Soil series: Rilloso. Classification: Sandy, mixed, thermic Typic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-010 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 90P 501, SAMPLE 90P 2809-2819

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CO3 AS	RES.	CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		CACO3	OHMS	GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	/CM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		PCT		<- -PCT ->			1:2	1:1
0- 8		1.1	TR	0.4					6.0	1		100	100	3					7.8	8.2
8- 20		1.1	TR	0.3					6.0	1		100	100	4					7.8	8.4
20- 31		1.2	0.1	0.2					5.8	1		100	100	8					7.8	8.1
31- 46		1.7	0.1	0.2					6.1	2		100	100	8					7.8	8.2
46- 64		2.2	0.1	0.2					6.3	2		100	100	6					7.8	8.3
64- 74		2.6	0.3	0.2					6.4	5		100	100	2					7.8	8.4
74- 82		3.0	0.7	0.2					6.1	11		100	100	6					7.9	8.8
82- 95		2.9	0.9	0.2					6.4	13		100	100	3					7.9	8.7
95-107		2.2	1.0	0.1					4.7	14	18	100	100	3	3400			8.6	8.0	8.8
107-115		2.2	1.2	0.2					4.5	19	10	100	100	3				8.3	8.0	8.7
115-125		2.6	1.7	0.2					5.0	25	14	100	100	2				8.4	8.0	8.8

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 8																		0.12
8- 20																		0.12
20- 31																		0.11
31- 46																		0.12
46- 64																		0.15
64- 74																		0.15
74- 82																		0.20
82- 95																		0.24
95-107	0.5	0.4	12.3	TR	--	2.4	0.5	8.6				2.5	0.3	0.3	29.7	TR	1.45	0.26
107-115	1.9	1.0	11.8	0.1	--	1.6	0.4	2.1				10.5	0.3	0.1	31.3	TR	1.53	0.41
115-125	1.2	0.8	13.8	0.1	--	1.9	0.6	3.8				9.9	0.6	--	33.1	TR	1.66	0.47

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S90NM-013-100
Location: SE$^{1}/_{4}$NE$^{1}/_{4}$ sec. 18, T. 22 S., R. 3 E., north bank of "Highway 70 gully," 15 m west of Yucca pedon sampled June 13, 1990
Elevation: 4,520 feet, 1,378 m
Landform: Ridge side sloping 1 percent west
Geomorphic surface: Isaacks' Ranch
Parent material: Isaacks' Ranch ridge alluvium derived primarily from monzonite and rhyolite, with a minor amount of limestone
Vegetation: Bush muhly, four-wing saltbush, dropseed, creosotebush, Mormon tea, fluffgrass, snakeweed
Described and sampled by: L.H. Gile
Date: June 11, 1990

E—0 to 3 cm; reddish brown (5YR 5.5/4) loamy sand, reddish brown (5YR 4/4) moist; dominantly weak medium platy structure and soft, with some plates separated by soft fine granules or by loose, single-grain material; very few fine roots; noncalcareous; abrupt smooth boundary.

BAt—3 to 8 cm; reddish brown (5YR 5.5/4) loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; common fine and very fine roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Bt—8 to 14 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine and medium roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Btk1—14 to 21 cm; reddish brown (5YR 5.5/4) gravelly sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine and medium roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; common insect burrows, mostly 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk2—21 to 37 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard and hard, very friable; few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common insect burrows, 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk3—37 to 55 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, very friable; few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common insect burrows, 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; about 2 percent carbonate nodules ranging from $^{1}/_{2}$ to 1 cm in diameter; strongly effervescent; clear wavy boundary.

Bk—55 to 71 cm; pinkish gray to light brown (7.5YR 6.5/3) gravelly sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, very friable; very few fine and medium roots; thin carbonate coatings on pebbles; about 20 percent irregular zones of K-fabric ranging from 1 to 10 cm in diameter; common insect burrows, mostly 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk—71 to 88 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, very friable; very few fine and medium roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; about 15 percent irregular zones of K-fabric ranging from 1 to 6 cm in diameter; common empty insect burrows, mostly 1 to 10 mm in diameter; strongly effervescent; clear wavy boundary.

BCtk—88 to 105 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

BCk—105 to 126 cm; light brown (6.5YR 6/4) gravelly sand, brown (6.5YR 4.5/4) moist; massive; soft, very friable; very few fine roots; thin, discontinuous carbonate coatings on pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

Ck—126 to 142 cm; light brown (6.5YR 6/4) loamy sand, brown (6.5YR 4.5/4) moist; massive and single grain; soft and loose, very friable; very few fine roots; thin, discontinuous carbonate coatings on some pebbles; a sandy loam stratum, 1 to 2 cm thick and with some sand grains coated with carbonate, about in the center of the horizon, included in sample; few empty insect burrows; strongly effervescent; clear wavy boundary.

C1—142 to 160 cm; light brown (6.5YR 6/4) sand, brown (6.5YR 4.5/4) moist; massive and single grain; soft and loose, very friable; very few medium roots; few empty insect burrows; strongly effervescent; abrupt wavy boundary.

C2—160 to 173 cm; light brown (6.5YR 6/4) sandy loam, brown (6.5YR 4.5/4) moist; slightly hard and hard, very friable; one root, 3 to 4 mm in diameter; few insect burrows; strongly effervescent.

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-100

(DONA ANA COUNTY, NEW MEXICO)

PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 91P 33, (RP91NM048) DESERT PROJECT
- PEDON 91P 190, SAMPLES 91P 1166-1178
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
SAMPLE NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002 -.05	SAND .05 -2	FINE LT .0002	CO3 LT .002	FINE .002 -.02	COARSE .02 -.05	VF .05 -.10	F .10 -.25	M .25 -.50	C .5 -1	VC 1 -2	- - - - WEIGHT 2 -5	5 -20	20 -75	- - - - .1- 75	WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - PCT OF <2MM	(3A1) - - - - - - - - - - - - - ->											<- PCT OF <75MM(3B1)->				
91P1166S	0- 3	E	5.9	13.7	80.4			5.2	8.5	29.4	25.0	11.0	7.2	7.8	7	4	--	56	11
91P1167S	3- 8	BAt	6.4	15.9	77.7			5.4	10.5	29.1	26.0	10.3	6.6	5.7	7	2	--	53	9
91P1168S	8- 14	Bt	9.8	15.8	74.4			5.5	10.3	26.0	25.1	10.6	7.9	4.8	6	2	--	53	8
91P1169S	14- 21	Btk1	10.3	17.0	72.7			6.4	10.6	24.7	23.2	10.3	7.8	6.7	6	3	--	53	9K
91P1170S	21- 37	Btk2	12.3	17.7	70.0		1.8	7.9	9.8	23.0	19.0	8.9	8.4	10.7	12	5	--	56	17K
91P1171S	37- 55	Btk3	13.0	23.2	63.8		2.1	9.6	13.6	18.1	12.8	6.5	9.8	16.6	16	5	--	57	21K
91P1172S	55- 71	Bk	16.2	23.8	60.0		4.9	10.8	13.0	18.3	13.2	5.2	6.8	16.5	21	13	--	62	34K
91P1173S	71- 88	Btk	14.5	20.8	64.7		3.4	8.8	12.0	19.2	19.9	7.2	6.0	12.4	22	10	--	63	32K
91P1174S	88-105	BCtk	10.0	16.5	73.5		1.5	6.9	9.6	15.8	15.8	9.0	11.4	21.5	21	16	4	75	41K
91P1175S	105-126	BCk	6.8	10.6	82.6		0.9	4.1	6.5	10.4	16.9	12.2	18.4	24.7	20	20	3	84	43K
91P1176S	126-142	Ck	8.3	10.4	81.3		0.9	3.9	6.5	7.9	13.4	13.8	24.3	21.9	16	5	3	80	24K
91P1177S	142-160	C1	3.4	2.6	94.0			1.1	1.5	3.4	9.7	24.7	28.4	27.8	21	9	--	93	30K

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3a <- PERCENT	(- - DITH-CIT - -) EXTRACTABLE FE 6C2b	AL 6G7a OF	MN 6D2a <2MM ->	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1 PCT	PI 4F <0.4MM	(- BULK DENSITY -) FIELD MOIST 4A3a <- -	1/3 BAR 4A1d G/CC	OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	(- - -WATER CONTENT - -) FIELD MOIST 4B4 <- - -	1/10 BAR 4B1c -PCT OF	1/3 BAR 4B1c <2MM	15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
0- 3	0.21								0.73										4.3	
3- 8	0.20								0.70										4.5	
8- 14	0.23								0.56										5.5	
14- 21	0.27								0.51										5.3	
21- 37	0.32								0.50										6.2	
37- 55	0.30								0.48										6.3	
55- 71	0.29								0.40										6.4	
71- 88	0.21								0.41										6.0	
88-105	0.17								0.52										5.2	
105-126	0.12								0.63										4.3	
126-142	0.07								0.52										4.3	
142-160	--								0.85										2.9	

AVERAGES, DEPTH 8- 55: PCT CLAY 11 PCT .1-75MM 55

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-100 PRINT DATE 03/04/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P 190, SAMPLE 91P 1166-1178

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE SAT-		CO3 AS	RES.		COND.	(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9b	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								1:2	1:1
0- 3														TR					7.6	8.0
3- 8														TR					7.8	8.4
8- 14														TR					7.8	8.4
14- 21K														1					7.8	8.3
21- 37K														6					7.8	8.3
37- 55K														5					7.8	8.3
55- 71K														11					7.8	8.3
71- 88K														11					7.8	8.3
88-105K														7					7.8	8.2
105-126K														5					7.9	8.4
126-142K														4					8.0	8.4
142-160K														3					8.0	8.7

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

SAMPLE NO.	DEPTH (CM)	HORIZON	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
			LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
91P1178S	160-173	C2	13.7	16.2	70.1		1.2	7.0	9.2	20.4	25.0	13.1	6.0	5.6	6	2	--	54	8K

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3a	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
160-173	0.08								0.45										6.2	

AVERAGES, DEPTH 8- 55: PCT CLAY 13 PCT .1-75MM 54

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-100 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P 190, SAMPLE 91P 1166-1178

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - - -)			AL	-BASE	SAT-	CO3 AS	RES.		COND.		(- - - -PH - - -)	
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9b	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - - ->								1:2	1:1
160-173K														8					7.9	8.3

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Yucca
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S90NM-013-101
Location: SE$^1/_4$NE$^1/_4$ sec. 18, T. 22 S., R. 3 E., north bank of “Highway 70 gully,” 15 m east of Yucca pedon sampled June 11, 1990
Elevation: 4,520 feet, 1,378 m
Landform: Ridge side sloping 1 percent west
Geomorphic surface: Isaacks’ Ranch
Parent material: Isaacks’ Ranch ridge alluvium derived primarily from rhyolite and monzonite, with a minor amount of limestone
Vegetation: Tarbush, snakeweed, mesquite, four-wing saltbush, dropseed, fluffgrass
Described and sampled by: L.H. Gile
Date: June 13, 1990

E—0 to 7 cm; reddish brown (5YR 5/4) sandy loam, reddish brown (5YR 4/4) moist; dominantly weak medium platy structure and soft, with some plates separated by soft fine granules or by loose, single-grain material; very few fine roots; noncalcareous; abrupt smooth boundary.

BAt—7 to 15 cm; reddish brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3.5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; sand grains coated with oriented clay; noncalcareous; abrupt smooth boundary.

Bt—15 to 24 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; sand grains coated with oriented clay; mostly noncalcareous but weakly effervescent in a few places; clear wavy boundary.

Btk1—24 to 33 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; few fine and medium roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common insect burrows, 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk2—33 to 52 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common insect burrows, 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk3—52 to 64 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common insect burrows, 1 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk4—64 to 75 cm; light brown (6.5YR 6/4) gravelly sandy loam, brown to dark brown (6.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; very few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; common empty insect burrows, 1 to 10 mm in diameter; about 5 percent carbonate nodules ranging from 1/2 to 2 cm in diameter; strongly effervescent; clear wavy boundary.

Btk5—75 to 86 cm; light brown (6.5YR 6.5/4) sandy loam, brown (6.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable; very few fine roots; some sand grains coated with oriented clay; thin carbonate coatings on pebbles; few empty insect burrows, ranging from about 2 to 5 cm high and up to 3 cm long horizontally; about 5 percent carbonate nodules ranging from 1/2 to 2 cm in diameter; strongly effervescent; clear wavy boundary.

BCtk1—86 to 101 cm; light brown (6.5YR 6.5/4) gravelly sandy loam, brown (6.5YR 5/4) moist; massive; soft and slightly hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on some pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

BCtk2—101 to 111 cm; light reddish brown (6YR 6.5/4) loamy sand, reddish brown (6YR 5/4) moist; massive; slightly hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on some pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

Ck1—111 to 119 cm; light brown (7.5YR 6.5/4) sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard and hard, very friable; very few fine roots; thin, discontinuous carbonate coatings on some pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

Ck2—119 to 143 cm; light brown (6.5YR 6.5/4) gravelly sand, brown (6.5YR 5/4) moist; massive and single grain; soft and loose, very friable; very few fine roots; thin, discontinuous carbonate coatings on some pebbles; few empty insect burrows; strongly effervescent; clear wavy boundary.

Ck3—143 to 150 cm; light brown (6.5YR 6.5/4) gravelly sandy loam, brown (6.5YR 5/4) moist; massive; hard and very hard, friable; very few fine roots; thin, discontinuous carbonate coatings on some pebbles; few empty insect burrows; strongly effervescent; abrupt irregular boundary.

C—150 to 166 cm; light brown (6.5YR 6.5/4) gravelly sand, brown (6.5YR 5/4) moist; massive; soft, very friable; no roots; strongly effervescent.

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-101 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 91P 33, (RP91NM048) DESERT PROJECT
- PEDON 91P 191, SAMPLES 91P 1179-1192
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)		
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT	
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF	
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE	
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL	
91P1179S	0- 7	E	7.7	15.3	77.0			4.6	10.7	23.9	28.1	12.3	7.0	5.7	6	3	5	60	14	
91P1180S	7- 15	BAt	7.6	16.1	76.3			6.2	9.9	26.7	26.9	12.6	6.4	3.7	2	1	--	51	3	
91P1181S	15- 24	Bt	11.0	14.7	74.3			6.2	8.5	26.5	24.2	12.1	7.4	4.1	4	2	--	51	6	
91P1182S	24- 33	Btk1	11.3	17.6	71.1		2.4	7.2	10.4	22.6	22.6	11.4	8.4	6.1	9	2	--	54	11K	
91P1183S	33- 52	Btk2	11.6	21.0	67.4		2.1	8.1	12.9	17.4	18.2	10.4	9.6	11.8	13	4	--	58	17K	
91P1184S	52- 64	Btk3	12.4	21.3	66.3		1.2	8.0	13.3	17.7	14.9	8.9	10.1	14.7	16	4	2	60	22K	
91P1185S	64- 75	Btk4	15.8	24.3	59.9		1.8	10.0	14.3	22.3	16.0	7.2	8.2	6.2	8	1	--	43	9K	
91P1186S	75- 86	Btk5	14.4	19.8	65.8		3.7	8.3	11.5	19.1	21.3	8.3	7.1	10.0	14	9	--	59	23K	
91P1187S	86-101	BCtk1	8.8	14.2	77.0		2.1	5.4	8.8	11.8	22.7	12.0	11.3	19.2	21	19	14	84	54K	
91P1188S	101-111	BCtk2	10.6	12.4	77.0		1.2	4.5	7.9	15.6	21.6	14.2	13.3	12.3	20	9	--	73	29K	
91P1189S	111-119	Ck1	10.6	10.6	78.8		2.1	4.3	6.3	14.0	19.2	10.2	11.1	24.3	17	17	13	81	47K	
91P1190S	119-143	Ck2	4.0	2.3	93.7			0.6	1.7	3.9	11.4	15.3	26.9	36.2	24	24	19	97	67K	

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3a <- PERCENT	DITH-CIT EXTRACTABLE FE 6C2b	AL 6G7a OF	MN 6D2a <2MM ->	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1 PCT	PI 4F <0.4MM	(- BULK DENSITY -) FIELD MOIST 4A3a <- - G/CC	1/3 BAR 4A1d	OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	(- - -WATER CONTENT - -) FIELD MOIST 4B4 <- - -PCT OF	1/10 BAR 4B1c	1/3 BAR 4B1c <2MM - ->	15 BAR 4B2a	WRD WHOLE SOIL 4C1 CM/CM
0- 7	0.26								0.52										4.0	
7- 15	0.24								0.55										4.2	
15- 24	0.25								0.48										5.3	
24- 33	0.31								0.52										5.9	
33- 52	0.29								0.50										5.8	
52- 64	0.25								0.46										5.7	
64- 75	0.25								0.42										6.6	
75- 86	0.20								0.42										6.1	
86-101	0.16								0.45										4.0	
101-111	0.13								0.37										3.9	
111-119	0.13								0.43										4.6	
119-143	0.05								0.80										3.2	

AVERAGES, DEPTH 15- 65: PCT CLAY 10 PCT .1-75MM 56

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-101 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P 191, SAMPLE 91P 1179-1192

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE	SAT-	CO3 AS	RES.		COND.		(- - - -PH - - -)	
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9b	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - - -PCT - - - - ->								1:2	1:1
0- 7														TR					7.7	8.4
7- 15														1					7.8	8.3
15- 24														1					7.7	8.2
24- 33K														6					7.8	8.4
33- 52K														6					7.8	8.2
52- 64K														7					7.8	8.3
64- 75K														12					7.8	8.2
75- 86K														10					7.8	8.1
86-101K														8					7.9	8.2
101-111K														4					7.9	8.2
111-119K														5					7.8	7.9
119-143K														2					7.8	8.2

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON		LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF

Soil series: Yucca. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S90NM-013-101 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P 191, SAMPLE 91P 1179-1192

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE SAT-		CO3 AS	RES.		COND.	(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9b	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - ->								1:2	1:1
143-150K														3					7.9	8.4
150-166K														2					8.0	8.9

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Reagan
Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid
Soil survey number: S91NM-013-010
Location: NW1/4NW1/4 sec. 27, T. 20 S., R. 2 E., about 0.24 mile north of road from South Well to Taylor Well
Elevation: 4,313 feet, 1,315 m
Landform: Toeslopes of alluvial fan piedmont sloping 1/2 percent to the west
Geomorphic surface: Petts Tank
Parent material: From 0 to 170 cm, Petts Tank alluvium derived mostly from limestone, sandstone, siltstone, and shale, with a lesser amount of rhyolite; from 170 to 498 cm, sandy sediments of the Camp Rice Formation (fluvial facies)
Vegetation: Mostly tarbush and burrograss; a few crucifixion thorns
Described and sampled by: L.H. Gile
Date: February 21, 1991

A—0 to 6 cm; pinkish gray (7.5YR 7/2) loam, brown (7.5YR 5/3) moist; moderate thin and medium platy structure; soft and slightly hard, very friable, strongly effervescent; abrupt wavy boundary.

Bw—6 to 21 cm; pinkish gray (7.5YR 7/2) clay loam, brown (7.5YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, friable; strongly effervescent; clear wavy boundary.

K21—21 to 35 cm; pinkish gray (7.5YR 7.5/2) silty clay, brown (7.5YR 5.5/3) moist; moderate fine and medium subangular blocky structure; hard, friable; strongly effervescent; clear wavy boundary.

K22—35 to 51 cm; pinkish white (7.5YR 8/2) silty clay, pinkish gray to light brown (7.5YR 6/3) moist; moderate fine and medium subangular blocky structure; hard and very hard, friable; strongly effervescent; clear wavy boundary.

K31—51 to 64 cm; pinkish gray to pink (7.5YR 7/3) silty clay, brown (7.5YR 5/3) moist; moderate fine and medium subangular blocky structure; hard and very hard, friable; strongly effervescent; clear wavy boundary.

K32—64 to 81 cm; pinkish gray to pink (7.5YR 7/3) clay, brown (7.5YR 5/3) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard and very hard, friable; strongly effervescent; clear wavy boundary.

Bk1—81 to 93 cm; pinkish gray to pink (7.5YR 7/3) clay loam, brown (7.5YR 5.5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard and very hard, friable; few fine carbonate nodules, 1 to 2 mm in diameter; strongly effervescent; clear wavy boundary.

Bk2—93 to 108 cm; light reddish brown (6YR 6.5/3) silty clay, reddish brown (6YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine carbonate nodules, 1 to 2 mm in diameter; strongly effervescent; clear wavy boundary.

Bk3—108 to 124 cm; light reddish brown (6YR 6.5/3.5) clay, reddish brown (6YR 5/3.5) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine carbonate nodules, 1 to 2 mm in diameter; strongly effervescent; clear wavy boundary.

Bk4—124 to 138 cm; pinkish gray to pink (7.5YR 7/3) silty clay, brown (7.5YR 5/3.5) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; few lighter colored parts; strongly effervescent; clear wavy boundary.

Bw1—138 to 155 cm; light reddish brown (6YR 6/3) clay loam, reddish brown (6YR 5/3.5) moist; moderate medium prismatic and moderate medium subangular blocky structure; very hard, friable; strongly effervescent; clear wavy boundary.

Bw2—155 to 170 cm; light reddish brown (6YR 6.5/3) clay loam, reddish brown (6YR 5/3.5) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, friable; strongly effervescent; clear wavy boundary.

2BAtb—170 to 179 cm; light reddish brown (5YR 6.5/3.5) sandy clay loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; very hard, friable; strongly effervescent; clear wavy boundary.

2BAtkb—179 to 195 cm; light reddish brown (6YR 6.5/3) fine sandy loam, reddish brown (6YR 5/3.5) moist; weak medium subangular blocky structure; very hard, friable; a few redder parts; few carbonate filaments; strongly effervescent; clear wavy boundary.

2Btb—195 to 203 cm; light reddish brown (5YR 6/3) fine sandy loam, reddish brown (5YR 5/3) moist; weak medium subangular blocky structure; hard, friable; strongly effervescent; clear wavy boundary.

2Bk1b—203 to 227 cm; pinkish gray to pink (7.5YR 7/3) clay loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; hard and very hard, very firm; strongly effervescent; abrupt smooth boundary.

2Bk2b—227 to 258 cm; a pinkish white (7.5YR 8/3), discontinuous gypsum hardpan, pinkish gray to light brown (7.5YR 6/3) moist; weak medium subangular blocky structure; very hard, very firm; few carbonate nodules; strongly effervescent; abrupt smooth boundary.

2Bk3b—258 to 277 cm; a white (10YR 8/2), discontinuous gypsum hardpan, grayish brown (10YR 5.5/2) moist; weak medium subangular blocky structure; very hard; few carbonate nodules; strongly effervescent; abrupt wavy boundary.

2C1b—277 to 294 cm; white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; hard and very hard, friable and firm; mostly noncalcareous; gypsum occurring as common discrete crystals and nests of crystals; abrupt smooth boundary.

2C2b—294 to 316 cm; white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; slightly hard and very hard, very friable, friable, and firm; noncalcareous; gypsum occurring as common discrete crystals and nests of crystals; abrupt smooth boundary.

2C3b—316 to 348 cm; white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6.5/2) moist; weak medium subangular blocky structure; slightly hard, hard, and very hard, very friable, friable, and firm; mostly noncalcareous; gypsum occurring as common discrete crystals and nests of crystals; abrupt smooth boundary.

2C4b—348 to 379 cm; white (10YR 8/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak fine and medium subangular blocky structure; slightly hard and very hard, very friable and firm; noncalcareous; gypsum occurring as common discrete crystals and nests of crystals; abrupt smooth boundary.

2C5b—379 to 398 cm; white (10YR 8/2) silt loam, pale brown (10YR 6.5/3) moist; weak medium subangular blocky structure; very hard, firm; mostly noncalcareous; gypsum occurring as roughly horizontal bands, 1 to 5 cm thick, and associated silty layers; abrupt smooth boundary.

2C6b—398 to 423 cm; white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; very hard, firm; noncalcareous; gypsum occurring as roughly horizontal bands, 1 to 5 cm thick, and associated silty layers; abrupt smooth boundary.

2C7b—423 to 439 cm; very pale brown (10YR 7.5/3) silt loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; very hard, firm; noncalcareous; gypsum occurring as roughly horizontal bands, 1 to 5 cm thick, and associated silty layers; abrupt smooth boundary.

2C8b—439 to 446 cm; very pale brown (10YR 7.5/3) silt loam, brown (10YR 5.5/3) moist; weak fine and medium subangular blocky structure; very hard, firm; noncalcareous; abrupt smooth boundary.

2C9b—446 to 469 cm; very pale brown (10YR 7.5/3) loam, brown (10YR 5.5/3) moist; weak medium subangular blocky structure; very hard, firm; noncalcareous; gypsum occurring as roughly horizontal bands, 1 to 5 cm thick, and associated silty layers; abrupt smooth boundary.

2C10b—469 to 475 cm; white (10YR 8/3) loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; very hard, firm; noncalcareous; gypsum occurring as roughly horizontal bands, 1 to 5 cm thick, and associated silty layers; abrupt wavy boundary.

2C11b—475 to 498 cm; pinkish gray to pink (7.5YR 7/3) coarse sand, brown (7.5YR 5/2) moist; massive and single grain; soft, loose; noncalcareous.

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S91NM-013-010 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

SSL - PROJECT 91P 188, (RP91NM264) RIO GRANDE
- PEDON 91P1185, SAMPLES 91P 7884-7912
- GENERAL METHODS 1B1A, 2A1, 2B

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
91P7884S	0- 6	A	19.2	41.0	39.8		5.2	22.2	18.8	22.3	11.4	4.8	1.1	0.2	--	--	--	17	--
91P7885S	6- 21	Bw	38.7	36.4	24.9		15.2	25.7	10.7	10.6	8.6	4.4	1.1	0.2	TR	--	--	14	--
91P7886S	21- 35	K21	41.4	40.7	17.9		19.7	32.5	8.2	7.9	5.5	3.5	0.8	0.2	TR	--	--	10	--
91P7887S	35- 51	K22	40.2	47.3	12.5		18.7	38.0	9.3	7.0	3.4	1.7	0.4	TR	TR	--	--	5	--
91P7888S	51- 64	K31	39.7	43.1	17.2		15.9	33.8	9.3	9.0	4.8	2.7	0.6	0.1	TR	--	--	8	--
91P7889S	64- 81	K32	41.0	38.5	20.5		15.6	30.3	8.2	8.9	6.2	4.2	1.1	0.1	TR	--	--	12	TR
91P7890S	81- 93	Bk1	39.2	33.4	27.4		14.4	27.6	5.8	11.3	10.3	5.2	0.6	TR	TR	--	--	16	--
91P7891S	93-108	Bk2	47.7	39.6	12.7		17.5	34.3	5.3	5.4	4.8	2.2	0.3	--	TR	--	--	7	--
91P7892S	108-124	Bk3	45.6	37.8	16.6		15.4	30.2	7.7	8.2	4.9	2.9	0.6	TR	1	--	--	9	1
91P7893S	124-138	Bk4	49.2	42.0	8.8		16.4	37.1	4.9	4.8	2.3	1.5	0.2	--	TR	--	--	4	TR
91P7894S	138-155	Bw1	38.1	36.1	25.8		10.8	25.3	10.8	17.3	7.0	1.3	0.2	TR	1	--	--	9	1
91P7895S	155-170	Bw2	34.8	32.8	32.4		8.9	21.6	11.2	19.5	8.8	3.6	0.5	--	TR	--	--	13	--

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 6	0.75							0.76	0.51										9.8	
6- 21	0.70							0.38	0.32										12.2	
21- 35	0.57							0.29	0.29										11.9	
35- 51	0.40							0.31	0.31										12.3	
51- 64	0.28							0.34	0.30										12.1	
64- 81	0.21							0.33	0.30										12.5	
81- 93	0.16							0.34	0.32										12.5	
93-108	0.16							0.32	0.30										14.4	
108-124	0.15							0.34	0.29										13.4	
124-138	0.16							0.32	0.30										14.8	
138-155	0.11							0.38	0.35										13.5	
155-170	0.11							0.39	0.36										12.4	

AVERAGES, DEPTH 25-100: PCT CLAY 24 PCT .1-75MM 10

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-010 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P1185, SAMPLE 91P 7884-7912

DEPTH (CM)	-1- NH4OAC EXTRACTABLE BASES CA 5B5a 6N2e	-2- MG 5B5a 6O2d	-3- NA 5B5a 6P2b	-4- K 5B5a 6Q2b	-5- SUM BASES	-6- ACID-ITY 6H5a	-7-	-8- CEC SUM CATS 5A3a	-9- CEC NH4-OAC 5A8b	-10- EXCH NA 5D2	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1g	-15- CARBONATE AS CACO3 <20MM 6E4	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f	-20- PH H2O 8C1f
	<- - - - - - - - - - -MEQ / 100 G								- - - ->	PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 6		2.2	TR	1.5					14.5	TR	TR	100	100	14		--		7.8	7.8	8.4
6- 21		2.8	0.2	1.0					14.6	1	TR	100	100	30		TR		7.6	7.6	7.8
21- 35		2.3	0.1	0.4					12.0	1	TR	100	100	46		--		7.6	7.6	7.9
35- 51		3.7	0.1	0.2					12.4	1	TR	100	100	45		--		7.6	7.6	7.9
51- 64		4.4	0.2	0.3					13.5	1	1	100	100	38		--		7.7	7.7	8.0
64- 81		6.1	0.3	0.4					13.7	1	1	100	100	36		--		7.8	7.7	8.0
81- 93		6.1	0.4	0.4					13.3	2	1	100	100	31		--		7.9	7.8	8.0
93-108		10.4	0.9	0.4					15.2	4	2	100	100	41		--		7.8	7.8	8.0
108-124		8.5	1.1	0.5					15.3	3	3	100	100	35		--		7.8	7.8	7.9
124-138		11.7	2.2	0.5					15.9	5	4	100	100	39		--		7.8	7.8	7.8
138-155		9.5	3.0	0.4					14.5	6	5	100	100	28		--		7.8	7.9	7.9
155-170		10.3	3.4	0.3					13.7	10	6	100	100	23		--		7.8	7.9	7.9

DEPTH (CM)	WATER EXTRACTED FROM SATURATED PASTE CA 6N1b	MG 6O1b	NA 6P1b	K 6Q1b	CO3 6I1b	HCO3 6J1b	F 6U1a	CL 6K1c	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1c	NO2 6W1a	NO3 6M1c	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - - - - - - - MEQ / LITER													- - ->	<- -PCT-	- ->		
0- 6	7.2	1.2	0.3	1.0	--	7.2	0.5	0.3				0.9	--	--	30.7	TR	0.84	0.29
6- 21	16.8	2.5	1.5	0.6	--	2.4	0.3	1.9				16.3	--	0.3	41.5	TR	1.71	0.71
21- 35	8.1	1.2	0.5	0.2	--	2.1	0.2	1.5				5.5	--	0.1	44.3	TR	0.91	0.42
35- 51	7.1	1.6	0.7	0.1	--	2.1	0.1	1.3				4.1	1.2	0.1	47.7	TR	0.87	0.38
51- 64	4.9	1.6	2.0	0.2	--	1.4	0.3	2.2				3.2	0.8	0.3	52.0	TR	0.86	0.40
64- 81	6.4	3.1	1.8	0.2	--	1.5	0.2	0.9				8.1	0.3	0.1	52.9	TR	1.01	0.49
81- 93	6.9	4.3	2.6	0.1	--	1.4	0.2	0.7				10.2	0.4	0.6	56.9	TR	1.18	0.53
93-108	9.7	7.1	5.8	0.3	--	0.9	0.5	2.3				12.1	0.7	6.1	53.6	0.1	1.97	0.89
108-124	13.8	12.2	9.8	0.2	--	0.8	1.0	5.1				5.9	1.4	24.2	64.4	0.1	3.15	1.32
124-138	39.2	36.3	23.5	0.3	--	0.5	1.8	15.1				11.9	2.6	74.7	61.9	0.4	7.35	3.06
138-155	55.4	48.7	34.7	0.4	--	0.4	2.6	28.4				17.3	--	102.5	60.0	0.4	9.32	3.97
155-170	53.8	51.1	41.2	0.3	--	0.5	2.6	32.2				19.6	--	97.9	50.1	0.4	9.74	3.58

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-010

PRINT DATE 03/04/02

SAMPLE NO.	DEPTH (CM) -1-	HORIZON -2-	-3-	TOTAL CLAY LT .002 -4-	TOTAL SILT .002 -.05 -5-	TOTAL SAND .05 -2 -6-	CLAY FINE LT .0002 -7-	CLAY CO3 LT .002 -8-	SILT FINE .002 -.02 -9-	SILT COARSE .02 -.05 -10-	SAND VF .05 -.10 -11-	SAND F .10 -.25 -12-	SAND M .25 -.50 -13-	SAND C .5 -1 -14-	SAND VC 1 -2 -15-	COARSE FRACTIONS (MM) WEIGHT 2 -5 -16-	5 -20 -17-	20 -75 -18-	.1- 75 -19-	(>2MM) WT PCT OF WHOLE SOIL -20-
				<- - - - - - - - - - - - -	PCT OF <2MM	(3A1)	- - - - - - - -	- - - -	- -	->	<- PCT OF	<75MM(3B1)		->	
91P7896S	170-179	2BAtb		22.1	16.4	61.5		4.9	8.7	7.7	20.9	25.6	12.8	2.0	0.2	TR	TR	--	41	TR
91P7897S	179-195	2BAtkb		18.0	16.7	65.3		4.0	9.0	7.7	21.1	26.5	15.3	2.1	0.3	TR	--	--	44	TR
91P7898S	195-203	2Btb		18.3	15.9	65.8		3.7	8.7	7.2	17.6	28.3	15.9	3.2	0.8	1	--	--	49	1
91P7899S	203-227	2Bk1b		30.0	31.7	38.3		8.7	21.0	10.7	13.3	15.6	7.3	1.7	0.4	1	1	--	26	2K
91P7900S	227-258	2Bk2b		1.9	46.0	52.1		1.2	34.6	11.4	18.1	19.0	10.1	4.2	0.7	4	1	--	37	5K
91P7901S	258-277	2Bk3b		2.9	42.7	54.4			29.5	13.2	27.3	13.4	8.8	4.5	0.4	3	TR	TR	29	3
91P7902S	277-294	2C1b		3.5	39.8	56.7		0.7	22.5	17.3	28.6	18.0	7.0	3.0	0.1	7	1	--	34	8
91P7903S	294-316	2C2b		5.2	24.6	70.2		0.7	12.7	11.9	27.5	35.9	5.1	1.6	0.1	TR	--	--	43	TR
91P7904S	316-348	2C3b		5.4	24.2	70.4		0.3	12.4	11.8	31.7	31.6	5.1	1.8	0.2	3	1	--	41	4
91P7905S	348-379	2C4b		3.2	32.5	64.3			12.2	20.3	46.3	14.4	2.7	0.9	--	4	1	--	22	5
91P7906S	379-398	2C5b		3.7	65.9	30.4			39.2	26.7	16.9	4.6	4.4	3.9	0.6	15	7	--	33	22
91P7907S	398-423	2C6b		3.9	57.8	38.3			24.0	33.8	31.8	5.6	0.8	0.1	TR	1	TR	--	7	1

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3b	DITH-CIT EXTRACTABLE FE 6C2b	AL 6G7a	MN 6D2a	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG - LIMITS -) LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3a	1/3 BAR 4A1d	OVEN DRY 4A1h	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1c	1/3 BAR 4B1c	15 BAR 4B2a	WRD WHOLE SOIL 4C1
				<- PERCENT	OF	<2MM	->			PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
170-179	0.05							0.44	0.34										7.6	
179-195	0.06							0.57	0.41										7.3	
195-203	0.05							0.57	0.38										6.9	
203-227	0.08							0.53	0.38										11.4	
227-258	0.03							6.89	5.37										10.2	
258-277	0.03							4.72	3.38										9.8	
277-294	0.02							3.94	3.09										10.8	
294-316	0.02							2.29	1.94										10.1	
316-348	0.03							2.28	1.19										6.4	
348-379	0.01							5.00	2.28										7.3	
379-398	0.01							5.65	3.35										12.4	
398-423	0.02							5.49	2.74										10.7	

AVERAGES, DEPTH 25-100: PCT CLAY 17 PCT .1-75MM 41

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-010 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P1185, SAMPLE 91P 7884-912

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
170-179		5.5	1.8	0.2					9.7	9	6	100	100	11		--		7.7	7.9	8.0
179-195		7.9	1.0	0.1					10.2	8	4	100	100	9		--		8.0	7.8	8.2
195-203		5.2	1.7	0.1					10.5	10	6	100	100	9		--		7.8	7.9	8.1
203-227K		8.1	1.8	0.2					16.0	7	3	100	100	20	20	TR		7.7	7.7	7.8
227-258K		5.3	2.0	0.1					13.1	6	5	100	100	4	5	27		7.7	7.7	7.7
258-277		8.7	4.6	0.1					13.7	16	10	100	100	4		25		7.6	7.7	7.7
277-294		8.5	5.0	--					13.8	16	11	100	100	1		22		7.5	7.6	7.6
294-316		8.1	5.2	--					11.9	21	12	100	100	1		18		7.6	7.8	7.8
316-348		6.7	1.8	--					12.3	8	5	100	100	2		15		7.6	7.6	7.6
348-379	104.2	9.9	2.1	TR	116.2	--		116.2	16.0	9	3	100	100	TR		8		7.6	7.6	7.6
379-398	160.3	12.8	6.2	0.1	179.4	0.6		180.0	20.9	16	11	100	100	TR		20		7.6	7.7	7.7
398-423	47.2	14.6	10.3	0.1	72.2	1.1		73.3	21.4	26	16	98	100	--		2		7.6	7.7	7.7

	(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - - MEQ / LITER ->														<- -PCT-	->	/cm	/cm
170-179	30.7	26.2	30.0	0.3	--	0.7	1.5	32.0				16.6	--	40.0	30.5	0.2	6.59	1.71
179-195	3.8	2.9	6.8	0.1	--	1.6	0.5	2.5				4.4	--	4.4	32.9	TR	1.35	0.44
195-203	15.5	12.4	22.5	0.2	--	1.1	1.5	14.2				29.6	--	6.5	31.9	0.1	4.03	1.08
203-227	23.6	11.6	14.1	0.3	--	1.0	1.5	2.3				45.2	--	1.4	49.8	0.1	3.33	1.69
227-258	26.3	17.0	23.9	0.3	--	0.9	1.2	12.0				48.9	--	4.9	48.0	0.2	4.52	3.03
258-277	29.3	23.7	52.9	0.3	--	0.9	2.4	44.8				56.0	--	12.3	45.7	0.3	8.05	3.73
277-294	31.7	35.7	63.0	0.3	--	0.9	2.9	57.0				61.4	--	15.2	43.8	0.3	9.15	4.08
294-316	31.5	33.4	70.2	0.2	--	0.8	4.2	57.2				55.6	--	17.7	38.2	0.3	9.85	4.08
316-348	25.8	24.2	23.7	0.2	--	1.1	1.7	8.2				57.1	--	5.8	38.3	0.1	4.85	3.03
348-379	22.2	21.0	15.7	0.2	--	1.1	1.3	2.7				53.4	--	2.6	43.3	0.1	3.85	2.84
379-398	21.0	32.7	55.9	0.3	--	1.4	2.3	7.6				93.2	--	8.8	52.7	0.3	7.17	4.02
398-423	20.9	56.9	98.4	0.2	--	1.3	5.4	14.0				156.7	--	13.7	48.4	0.4	11.20	4.74

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-010 PRINT DATE 03/04/02

SAMPLE NO.	DEPTH (CM)	HORIZON	-1- CLAY LT .002 (TOTAL)	-2- SILT .002 -.05 (TOTAL)	-3- SAND .05 -2 (TOTAL)	-4- FINE LT .0002 (CLAY)	-5- CO3 LT .002 (CLAY)	-6- FINE .002 -.02 (SILT)	-7- COARSE .02 -.05 (SILT)	-8- VF .05 -.10 (SAND)	-9- F .10 -.25 (SAND)	-10- M .25 -.50 (SAND)	-11- C .5 -1 (SAND)	-12- VC 1 -2 (SAND)	-13- 2 -5 (COARSE FRACTIONS (MM) WEIGHT)	-14- 5 -20	-15- 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- - - - -	- - - - -	- - - PCT OF	<2MM	(3A1) - - -	- - - - -	- - - - -	- - - - -	- - - -	- - -	- - ->		<- PCT OF	<75MM(3B1)	->		SOIL
91P7908S	423-439	2C7b	13.2	68.6	18.2			39.6	29.0	11.8	2.1	2.6	1.7	TR	8	1	--	15	9
91P7909S	439-446	2C8b	2.2	83.9	13.9			67.8	16.1	8.3	0.1	3.1	1.9	0.5	24	5	--	33	29
91P7910S	446-469	2C9b	20.3	43.4	36.3			26.7	16.7	5.6	8.3	13.6	7.0	1.8	1	--	--	31	1
91P7911S	469-475	2C10b	19.9	36.5	43.6			24.3	12.2	6.3	10.5	17.2	7.5	2.1	4	2	--	41	6
91P7912S	475-498	2C11b	2.7	2.1	95.2			1.0	1.1	0.5	12.2	47.4	27.2	7.9	6	4	--	95	10

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3b	DITH-CIT EXTRACTABLE FE 6C2b	AL 6G7a	MN 6D2a	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG - LIMITS -) LL 4F1	PI 4F	(BULK DENSITY) FIELD MOIST 4A3a	1/3 BAR 4A1d	OVEN DRY 4A1h	COLE WHOLE SOIL 4D1	(WATER CONTENT) FIELD MOIST 4B4	1/10 BAR 4B1c	1/3 BAR 4B1c	15 BAR 4B2a	WRD WHOLE SOIL 4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
423-439	0.02							2.00	1.05										13.8	
439-446	0.01							14.82	9.05										19.9	
446-469	0.03							1.08	0.69										14.1	
469-475	0.03							0.99	0.59										11.8	
475-498	TR							1.74	1.04										2.8	

DEPTH (CM)	(NH4OAC EXTRACTABLE BASES) CA 5B5a 6N2e	MG 5B5a 6O2d	NA 5B5a 6P2b	K 5B5a 6Q2b	SUM BASES	ACID-ITY 6H5a	(CEC) SUM CATS 5A3a	NH4-OAC 5A8b	EXCH NA 5D2	SAR 5E	BASE SATURATION SUM 5C3	NH4OAC 5C1	CARBONATE AS CACO3 <2MM 6E1g	<20MM 6E4	CASO4 AS GYPSUM <2MM 6F1a	<20MM 6F4	(PH) SAT PASTE 8C1b	CACL2 .01M 8C1f	H2O 8C1f
	<- - - - -	- - - -	- - -MEQ	/ 100 G	- - - -	- - - -	- - -	->	PCT		<- -PCT-	>	<- -PCT	->	<- -PCT	->		1:2	1:1
423-439	125.0	16.6	10.4	0.2	152.2	1.0	153.2	26.4	20	16	99	100	TR		10		7.6	7.7	7.7
439-446	139.1	27.1	13.7	0.4	180.3	1.6	181.9	32.6	22	13	99	100	TR		12		7.4	7.5	7.5
446-469	67.1	20.8	15.1	0.1	103.1	0.9	104.0	22.0	38	18	99	100	--		3		7.4	7.6	7.5
469-475	47.5	18.2	10.2	0.1	76.0	0.7	76.7	19.6	25	17	99	100	TR		2		7.4	7.6	7.6
475-498	2.0	2.3	1.1	--	5.4	--	5.4	4.7	16	9	100	100	TR				7.9	7.2	7.6

AVERAGES, DEPTH 25-100: PCT CLAY 13 PCT .1-75MM 15

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-010 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P1185, SAMPLE 91P 7884-7912

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- - - WATER EXTRACTED FROM SATURATED PASTE- - -)																	PRED.		
																TOTAL	ELEC.	ELEC.		
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.		
DEPTH																EST.	8A3a	8I		
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS		
	<- - - MEQ / LITER - - ->														<- -PCT- ->		/cm	/cm		
423-439	24.4	47.8	93.8	0.2	--	1.3	3.6	27.4				111.1	--	16.1	53.5	0.5	11.40	4.87		
439-446	32.8	57.6	90.7	0.3	--	1.0	4.2	56.6				76.8	6.0	33.7	71.6	0.8	13.10	5.94		
446-469	38.9	91.7	148.0	0.4	--	0.7	7.9	117.9				79.8	--	70.0	45.6	0.7	19.50	6.61		
469-475	45.0	83.2	139.9	0.4	--	0.9	8.0	117.7				74.7	--	67.6	37.8	0.6	19.30	5.86		
475-498	2.2	3.4	15.4	0.1	--	1.4	0.5	4.1				12.3	--	2.7	20.9	TR	2.16	0.43		

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Herbel
Classification: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torriorthent
Soil survey number: S91NM-013-011
Location: NW1/4NW1/4SE1/4 sec. 28, T. 21 S., R. 2 E., north bank of arroyo
Elevation: 4,400 feet, 1,341 m
Landform: Alluvial fan sloping 3 percent to the east
Geomorphic surface: Organ
Parent material: Organ fan alluvium derived from monzonite, rhyolite, andesite, and latite
Vegetation: Creosotebush
Described and sampled by: L.H. Gile
Date: December 27, 1990

A—0 to 4 cm; brown (7.5YR 5.5/3) sandy loam, dark brown (7.5YR 4/3) moist; weak medium platy and weak fine granular structure; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; thin, discontinuous carbonate coatings on pebbles; moderately alkaline; abrupt smooth boundary.

Bk1—4 to 24 cm; brown (7.5YR 5.5/3) sandy loam, dark brown (7.5YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; weak stratification in some of the lower part; strongly effervescent; thin, discontinuous carbonate coatings on pebbles; moderately alkaline; abrupt and clear wavy boundary.

Bk2—24 to 43 cm; brown (7.5YR 5.5/3) sandy loam, dark brown (7.5YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; weak stratification in some of the lower part; strongly effervescent; thin, discontinuous carbonate coatings on pebbles; moderately alkaline; abrupt and clear wavy boundary.

Bk3—43 to 59 cm; brown (7.5YR 5.5/3) sandy loam, dark brown (7.5YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; strongly effervescent; thin, mostly discontinuous carbonate coatings on pebbles; moderately alkaline; clear wavy boundary.

Bk4—59 to 85 cm; brown (7.5YR 5.5/3) sandy loam, dark brown (7.5YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; strongly effervescent; thin, mostly discontinuous carbonate coatings on pebbles; moderately alkaline; clear wavy boundary.

Bk5—85 to 99 cm; brown (7.5YR 5.5/3) loamy sand, dark brown (7.5YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; strongly effervescent; thin, discontinuous carbonate coatings on pebbles; moderately alkaline; abrupt wavy boundary.

Ck—99 to 110 cm; brown (7.5YR 5.5/3) gravelly sand, dark brown (7.5YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; thin, discontinuous carbonate coatings on pebbles; moderately alkaline; clear wavy boundary.

C1—110 to 125 cm; brown (7.5YR 5.5/3) very gravelly sand, dark brown (7.5YR 4/3 moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; moderately alkaline; clear wavy boundary.

C2—125 to 132 cm; brown (7.5YR 5.5/3) gravelly sand, dark brown (7.5YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; strongly effervescent; moderately alkaline.

Soil series: Herbel. Classification: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torriorthent.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-011 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 91P 188, (RP91NM264) RIO GRANDE
- PEDON 91P1184, SAMPLES 91P 7875-7883
- GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002 -.05	SAND .05 -2	FINE CLAY LT .0002	CO3 CLAY LT .002	FINE SILT .002 -.02	COARSE SILT .02 -.05	VF SAND .05 -.10	F SAND .10 -.25	M SAND .25 -.50	C SAND .5 -1	VC SAND 1 -2	WEIGHT 2 -5	WEIGHT 5 -20	WEIGHT 20 -75	WEIGHT .1- 75	WT PCT OF WHOLE SOIL
	-1-	-2-	-3- / -4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			<- - - PCT OF <2MM (3A1)											->	<- PCT OF <75MM(3B1)			->	
91P7875S	0- 4	A	7.5	18.8	73.7		0.6	5.9	12.9	25.5	23.8	9.8	7.0	7.6	8	9	3	59	20 2
91P7876S	4- 24	Bk1	7.4	19.0	73.6			5.2	13.8	30.4	24.9	8.1	5.2	5.0	7	10	--	53	17K
91P7877S	24- 43	Bk2	8.3	18.1	73.6		0.3	6.1	12.0	24.0	22.8	10.0	7.3	9.5	7	8	--	57	15K
91P7878S	43- 59	Bk3	8.5	19.4	72.1		0.3	6.8	12.6	29.6	21.5	10.3	6.2	4.5	8	11	--	53	19K
91P7879S	59- 85	Bk4	10.2	19.7	70.1		1.5	6.2	13.5	24.8	25.3	11.0	5.7	3.3	6	11	--	55	17K
91P7880S	85- 99	Bk5	9.8	17.6	72.6		0.9	6.2	11.4	23.0	24.3	10.8	6.6	7.9	8	12	--	60	20K
91P7881S	99-110	Ck	8.5	13.4	78.1			5.0	8.4	16.6	23.1	15.5	12.4	10.5	16	30	--	79	46K
91P7882S	110-125	C1	9.4	14.5	76.1			7.1	7.4	10.4	14.6	19.1	16.9	15.1	10	45	8	87	63 2
91P7883S	125-132	C2	6.2	10.7	83.1		0.3	4.2	6.5	7.2	11.3	16.0	22.6	26.0	23	24	7	89	54 2

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B3a <2MM	EXTR P 6S3 PPM	TOTAL S 6R3b <- PERCENT	DITH-CIT EXTRACTABLE FE 6C2b	DITH-CIT EXTRACTABLE AL 6G7a OF	DITH-CIT EXTRACTABLE MN 6D2a <2MM ->	(RATIO/CLAY) CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	(ATTERBERG LIMITS) LL 4F1 PCT <0.4MM	(ATTERBERG LIMITS) PI 4F	BULK DENSITY FIELD MOIST 4A3a <- - G/CC	BULK DENSITY 1/3 BAR 4A1d	BULK DENSITY OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	WATER CONTENT FIELD MOIST 4B4 <- - -PCT OF	WATER CONTENT 1/10 BAR 4B1c <2MM	WATER CONTENT 1/3 BAR 4B1c	WATER CONTENT 15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
0- 4	0.31								0.72										5.4	
4- 24	0.29								0.72										5.3	
24- 43	0.36								0.71										5.9	
43- 59	0.38								0.74										6.3	
59- 85	0.38								0.63										6.4	
85- 99	0.79								0.73										7.2	
99-110	0.52								0.67										5.7	
110-125	0.35								0.66										6.2	
125-132	0.25								0.85										5.3	

AVERAGES, DEPTH 25-100: PCT CLAY 8 PCT .1-75MM 56

Soil series: Herbel. Classification: Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torriorthent.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S91NM-013-011 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 91P1184, SAMPLE 91P 7875- 7883

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE SAT-		CO3 AS	RES.		COND.	(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9c	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - - ->								1:2	1:1
0- 4														3					7.9	8.3
4- 24K														1					7.9	8.5
24- 43K														4					7.8	8.1
43- 59K														3					7.8	7.9
59- 85K														4					7.8	7.9
85- 99K														3					7.8	8.1
99-110K														4					7.8	8.1
110-125														5					7.8	8.3
125-132														5					7.8	8.3

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Bluepoint
Classification: Mixed, thermic Typic Torripsamment
Soil survey number: S92NM-013-001
Location: NW1/4NE1/4 sec. 18, T. 22 S., R. 3 E., 100 m south of U.S. Highway 70; east side of study trench
Elevation: 4,520 feet, 1,378 m
Landform: Ridge crest sloping 1 percent west
Geomorphic surface: Isaacks' Ranch
Parent material: Isaacks' Ranch ridge alluvium derived primarily from monzonite and rhyolite, with a minor amount of limestone
Vegetation: Dropseed, four-wing saltbush, fluffgrass, mesquite, soaptree yucca
Described and sampled by: L.H. Gile
Date: November 29, 1991

E—0 to 5 cm; reddish brown (6YR 5/4) loamy sand, dark reddish brown (6YR 3.5/4) moist; weak thin and medium platy structure; soft, loose, very friable; very few fine roots; abrupt smooth boundary.
BAt—5 to 14 cm; reddish brown (5YR 5/4) gravelly loamy sand, dark reddish brown (5YR 3.5/4) moist; weak fine subangular blocky structure; soft, very friable; few fine and very fine roots; clear wavy boundary.
Bt—14 to 28 cm; yellowish red (5YR 5/5) gravelly loamy sand, yellowish red (5YR 3.5,1/5) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine and very fine roots; sand grains coated with oriented clay; few fine and very fine roots; clear wavy boundary.
Btk1—28 to 40 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
Btk2—40 to 58 cm; reddish brown (5YR 5.5/3.5) gravelly loamy sand, reddish brown (5YR 4/3.5) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles, some continuous; strongly effervescent; clear wavy boundary.
Btk3—58 to 83 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
Btk4—83 to 106 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
BCtk1—106 to 125 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
BCtk2—125 to 162 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; massive; soft, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
C1—162 to 190 cm; light reddish brown (6YR 6/4) gravelly sand, reddish brown (6YR 4.5/4) moist; massive; soft, very friable; very few fine roots; strongly effervescent; clear wavy boundary.
C2—190 to 231 cm; light reddish brown (5YR 6/4) gravelly sand, reddish brown (5YR 4.5/4) moist; massive; soft and slightly hard, very friable; strongly effervescent; abrupt wavy boundary.
Btkb—231 to 236 cm; reddish brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3.5/4) moist; weak coarse subangular blocky structure; very hard, friable; common carbonate filaments and nodules; strongly effervescent.

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 92P 156, (RP92NM233) DESERT PROJECT STUDY
- PEDON 92P 834, SAMPLES 92P 5142-5153
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND-	- - - -	-)		(-COARSE FRACTIONS(MM)-)				(>2MM)
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON		LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
				<- - - - -	- - - -	- - - -	- - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - -	- -	->	<- PCT OF	<75MM(3B1)		->	SOIL
92P5142S	0- 5	E		6.5	12.6	80.9			3.5	9.1	27.1	28.1	11.2	7.1	7.4	6	2	--	57	8
92P5143S	5- 14	BAt		7.5	13.2	79.3			3.5	9.7	27.4	23.6	10.4	7.3	10.6	12	3	1	60	16
92P5144S	14- 28	Bt		8.9	11.8	79.3			2.4	9.4	20.5	23.3	12.1	11.0	12.4	9	4	1	65	14
92P5145S	28- 40	Btk1		7.9	12.1	80.0		1.8	3.0	9.1	19.5	19.5	11.6	11.6	17.8	11	8	1	68	20
92P5146S	40- 58	Btk2		7.4	13.4	79.2		1.8	4.1	9.3	19.8	20.6	11.7	11.3	15.8	15	9	--	69	24
92P5147S	58- 83	Btk3		6.8	13.5	79.7		2.1	3.6	9.9	17.9	18.9	12.7	13.2	17.0	14	7	--	70	21
92P5148S	83-100	Btk4		5.6	14.5	79.9		0.3	4.3	10.2	15.7	17.9	13.3	14.6	18.4	16	10	2	74	28
92P5149S	100-125	BCtk1		5.8	12.9	81.3		0.3	4.3	8.6	13.8	16.4	14.5	16.3	20.3	16	10	2	77	28
92P5150S	125-162	BtCk2		5.3	9.3	85.4		1.2	2.6	6.7	9.3	13.2	16.0	21.2	25.7	19	11	1	84	31
92P5151S	162-190	C1		3.6	4.0	92.4		1.5	0.9	3.1	5.3	14.8	19.0	25.1	28.2	22	11	--	91	33
92P5152S	190-231	C2		3.6	3.4	93.0		0.9	1.6	1.8	3.4	10.8	17.5	28.3	33.0	26	20	3	95	49
92P5153S	231-236	Btkb		19.4	14.2	66.4		2.8	6.8	7.4	14.5	25.2	10.8	8.6	7.3	9	4	--	58	13

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -	-)	(RATIO/CLAY)		(ATTERBERG	)	(- BULK DENSITY	-)		COLE	(- - -WATER CONTENT	- -)			WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM	—>			PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
0- 5	0.26							1.03	0.60										3.9	
5- 14	0.20							0.93	0.51										3.8	
14- 28	0.18							0.90	0.51										4.5	
28- 40	0.17							0.85	0.49										3.9	
40- 58	0.17							0.82	0.57										4.2	
58- 83	0.14							0.82	0.54										3.7	
83-100	0.05							0.93	0.61										3.4	
100-125	0.09							0.90	0.60										3.5	
125-162	0.01							0.91	0.66										3.5	
162-190	0.01							0.89	0.78										2.8	
190-231	0.01							1.08	0.75										2.7	
231-236	0.01							0.55	0.41										8.0	

AVERAGES, DEPTH 25-100: PCT CLAY 5 PCT .1-75MM 70

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 92P 834, SAMPLE 92P 5142- 5153

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5	7.0	1.2	0.2	0.5	8.9	0.3		9.2	6.7	3		97	100						7.3	7.7
5- 14	8.4	1.1	0.1	0.6	10.2	0.1		10.3	7.0	2		99	100						7.6	8.2
14- 28	8.5	1.1	0.1	0.7	10.4	0.1		10.5	8.0	2		99	100	TR					7.7	8.3
28- 40		1.5	0.1	0.1					6.7	2		100	100	1					7.7	8.3
40- 58		1.7	0.2	0.3					6.1	4		100	100	2					7.7	8.3
58- 83		2.0	0.2	0.4					5.6	3		100	100	2					7.8	8.3
83-100		2.3	0.2	0.5					5.2	4		100	100	2					7.8	8.4
100-125		2.7	0.2	0.5					5.2	4		100	100	2					7.9	8.5
125-162		2.7	0.3	0.4					4.8	6	1	100	100	2				7.7	7.9	8.4
162-190		2.0	0.4	0.1					3.2	8	2	100	100	2		TR		7.7	7.8	8.1
190-231		2.4	0.7	0.1					3.9	11	3	100	100	2		TR		7.8	7.8	8.0
231-236		9.2	1.8	0.3					10.7	11	7	100	100	7		TR		8.0	7.9	8.3

	(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.19
5- 14																		0.14
14- 28																		0.14
28- 40																		0.16
40- 58																		0.17
58- 83																		0.17
83-100																		0.17
100-125																		0.18
125-162	3.5	2.3	2.5	1.0		2.0	0.1	1.2				5.4			18.9	TR	0.87	0.25
162-190	22.4	9.7	6.7	1.4		0.7		5.6				30.2			20.6	TR	2.75	0.66
190-231	28.3	12.5	12.7	0.7		0.8		6.6				44.9			21.3	0.1	3.62	1.20
231-236	8.1	7.5	18.7	0.3		1.2		11.2				22.1			35.6	0.1	2.87	0.80

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Amole
Classification: Sandy, mixed, thermic Typic Torriorthent
Soil survey number: S92NM-013-002
Location: NW1/4NE1/4 sec. 18, T. 22 S., R. 3 E., 100 m south of U.S. Highway 70; west side of study trench
Elevation: 4,520 feet, 1,378 m
Landform: Ridge crest sloping 1 percent west
Geomorphic surface: Isaacks' Ranch
Parent material: Isaacks' Ranch ridge alluvium derived primarily from monzonite and rhyolite, with a minor amount of limestone
Vegetation: Dropseed, four-wing saltbush, fluffgrass, mesquite, soaptree yucca
Described and sampled by: L.H. Gile
Date: February 11, 1992

E—0 to 5 cm; reddish brown (5YR 5/4) loamy sand, dark reddish brown (5YR 3.5/4) moist; weak thin and medium platy structure; soft, loose, very friable; very few fine roots; abrupt smooth boundary. (Offset sample, 1.9 m to east.)

Bt—5 to 19 cm; yellowish red (5YR 5/5) gravelly loamy sand, yellowish red (5YR 3.5/5) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine and very fine roots; sand grains coated with oriented clay; weakly effervescent in a few spots; clear wavy boundary.

Btk1—19 to 30 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard and hard, very friable; few fine and very fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Btk2—30 to 43 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, continuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Btk3—43 to 60 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, continuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Btk4—60 to 78 cm; reddish brown (5YR 5.5/4) gravelly loamy sand, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, continuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Btk5—78 to 102 cm; reddish brown (5YR 5.5/4) gravelly sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; some sand grains coated with oriented clay; thin, continuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Btk6—102 to 125 cm; light reddish brown (6YR 6.5/3) sandy loam, reddish brown (6YR 5/3) moist; weak medium and coarse subangular blocky structure; hard and very hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, continuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

BCtk—125 to 146 cm; light reddish brown (6YR 6/3) gravelly sandy loam, reddish brown (6YR 4.5/3) moist; weak medium and coarse subangular blocky structure; slightly hard and hard, very friable; very few fine roots; some sand grains coated with oriented clay; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Ck—146 to 166 cm; reddish brown (5YR 5.5/3) gravelly loamy sand, reddish brown (5YR 4/3) moist; massive; soft and slightly hard, very friable; very few fine roots; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

C—166 to 185 cm; light reddish brown (6YR 6/3) gravelly sand, reddish brown (6YR 4.5/3) moist; massive; soft and slightly hard, very friable; strongly effervescent.

Soil series: Amole. Classification: Sandy, mixed, thermic Typic Torriorthent.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-002 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 92P 156, (RP92NM233) DESERT PROJECT STUDY
- PEDON 92P 835, SAMPLES 92P 5154-5164
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND-	-	- - - -)	(-COARSE	FRACTIONS(MM)	-)			(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - - -	- - - ->	<- PCT OF	<75MM(3B1)		->	SOIL
92P5154S	0- 5	E	6.3	13.0	80.7			3.2	9.8	30.2	28.8	11.9	6.1	3.7	8	3	--	56	11
92P5155S	5- 19	Bt	7.4	13.7	78.9		1.8	2.8	10.9	23.1	23.6	12.0	10.7	9.5	17	7	--	66	24
92P5156S	19- 30	Btk1	7.8	12.5	79.7			1.8	10.7	23.7	21.2	10.4	10.1	14.3	22	9	--	70	31
92P5157S	30- 43	Btk2	6.6	12.7	80.7		1.8	2.6	10.1	19.2	21.1	11.5	12.1	16.8	17	8	--	71	25
92P5158S	43- 60	Btk3	7.3	13.0	79.7		0.6	2.7	10.3	21.8	23.1	12.4	11.1	11.3	14	6	2	67	22
92P5159S	60- 78	Btk4	7.8	13.3	78.9		0.6	2.6	10.7	21.3	21.5	12.6	13.0	10.5	14	5	--	66	19
92P5160S	78-102	Btk5	7.6	15.1	77.3			4.1	11.1	19.6	18.7	12.3	13.4	13.3	8	18	--	69	26
92P5161S	102-125	Btk6	11.3	18.5	70.2		2.4	6.3	12.2	18.0	20.9	10.1	9.4	11.8	10	3	--	58	13
92P5162S	125-146	BCtk	8.5	14.4	77.1		3.0	5.6	8.9	12.6	15.6	12.2	15.2	21.5	20	14	--	77	34
92P5163S	146-166	Ck	6.7	10.8	82.5		1.5	3.8	7.0	10.7	15.7	14.3	19.0	22.8	20	15	2	82	37
92P5164S	166-185	C	4.8	6.9	88.3		1.2	1.9	5.0	8.3	17.9	22.9	21.9	17.3	22	16	1	88	39

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK	DENSITY -)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
0- 5	0.37							1.00	0.57										3.6	
5- 19	0.20							0.82	0.55										4.1	
19- 30	0.20							0.92	0.49										3.8	
30- 43	0.17							0.83	0.58										3.8	
43- 60	0.22							0.84	0.58										4.2	
60- 78	0.12							0.73	0.53										4.1	
78-102	0.09							0.75	0.55										4.2	
102-125	0.08							0.53	0.42										4.8	
125-146	0.07							0.62	0.52										4.4	
146-166	0.07							0.70	0.57										3.8	
166-185	0.02							0.85	0.71										3.4	

AVERAGES, DEPTH 5- 55: PCT CLAY 6 PCT .1-75MM 68

Soil series: Amole. Classification: Sandy, mixed, thermic Typic Torriorthent.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 92P 835, SAMPLE 92P 5154-5164

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5	6.3	1.3	0.1	0.9	8.6	0.6		9.2	6.3	2		93	100						7.2	7.8
5- 19	28.2	1.3	TR	0.6	30.1	--		30.1	6.1	TR		100	100	--					7.7	8.2
19- 30		1.0	0.1	0.7					7.2	1		100	100	2					7.6	8.2
30- 43		1.8	0.1	0.4					5.5	2		100	100	2					7.7	8.3
43- 60		1.5	TR	0.4					6.1	1		100	100	2					7.7	8.2
60- 78		2.0	0.1	0.6					5.7	2		100	100	2					7.8	8.3
78-102		2.2	0.2	0.7					5.7	3		100	100	3					7.8	8.3
102-125		3.2	0.2	0.9					6.0	3	1	100	100	9				7.9	7.8	8.2
125-146		2.9	0.3	0.9					5.3	4	2	100	100	7				7.8	7.8	8.1
146-166		2.2	0.3	0.6					4.7	4	2	100	100	3		TR		7.7	7.8	8.0
166-185		1.8	0.4	0.5					4.1	6	2	100	100	2		TR		7.7	7.7	7.8

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.18
5- 19																		0.18
19- 30																		0.15
30- 43																		0.15
43- 60																		0.16
60- 78																		0.18
78-102																		0.20
102-125	4.7	2.3	2.2	1.1		2.3		0.6				6.9			26.4	TR	0.95	0.30
125-146	8.0	3.8	4.1	1.5		1.5		0.8				14.7			22.2	TR	1.48	0.39
146-166	18.8	6.0	6.9	2.0		1.2		2.9				28.2			19.2	TR	2.44	0.53
166-185	26.6	7.8	7.7	1.7		1.6		5.4				34.6			19.7	TR	2.99	1.22

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Sonoita
Classification: Coarse-loamy, mixed, superactive, thermic Typic Haplargid
Soil survey number: S92NM-013-003
Location: NW1/4SW1/4NE1/4 sec. 2, T. 21 S., R. 1 W., north bank of freshly graded road
Elevation: 4,160 feet, 1,268 m
Landform: Ridge crest sloping 3 percent west
Geomorphic surface: Eolian analog of Leasburg
Parent material: Sandy eolian material
Vegetation: Mostly creosotebush, with a few snakeweeds
Described and sampled by: L.H. Gile
Date: April 1, 1992

A—0 to 5 cm; yellowish red (5YR 5/5) fine sandy loam, yellowish red (5YR 4/5) moist; crusted and weak thin platy structure in the upper 2 to 5 mm; material beneath is a loose mass of soft, fine and very fine pebbles; some parts noncalcareous and other parts slightly effervescent; abrupt smooth boundary.

BAtk1—5 to 8 cm; yellowish red (5YR 5/5) sandy loam, yellowish red (5YR 4/5) moist; weak medium subangular blocky structure; slightly hard, very friable; few carbonate filaments in places; some parts noncalcareous and other parts slightly effervescent; clear wavy boundary.

BAtk2—8 to 17 cm; reddish brown (6YR 5.5/4) sandy loam, reddish brown (6YR 4/4) moist; a few parts 5YR 5/4 dry; weak very coarse prismatic structure parting to weak coarse subangular blocky; hard, very friable; few carbonate filaments; 5YR parts noncalcareous or slightly effervescent and 6YR parts strongly effervescent; clear wavy boundary.

Btk1—17 to 33 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount 6YR 5.5/4 dry; weak very coarse prismatic structure parting to weak coarse subangular blocky; very hard, very friable; few carbonate filaments; 5YR parts noncalcareous or slightly effervescent and 6YR parts strongly effervescent; clear wavy boundary.

Btk2—33 to 46 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount 6YR 5.5/4 dry; weak very coarse prismatic structure parting to weak coarse subangular blocky; very hard, very friable; few carbonate filaments; a few discontinuous, roughly vertical carbonate bands, commonly about 2 cm in diameter, ranging from 1 to 3 cm in diameter; the bands occurring as joint fillings between prisms; few carbonate nodules; 5YR parts noncalcareous or slightly effervescent and 6YR parts strongly effervescent; clear wavy boundary.

Btk3—46 to 65 cm; light reddish brown (6YR 6/4) sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount 5YR 5/4 dry; weak very coarse prismatic structure parting to weak coarse subangular blocky; hard and very hard, very friable; few carbonate filaments; a few discontinuous, roughly vertical carbonate bands, commonly about 2 cm in diameter, ranging from 1 to 3 cm in diameter; the bands occurring as joint fillings between prisms; few carbonate nodules; 5YR parts noncalcareous or slightly effervescent and 6YR parts strongly effervescent; clear wavy boundary.

Btk4—65 to 81 cm; light reddish brown (6YR 6.5/4) loamy sand, reddish brown (6YR 5/4) moist; a few parts with 5YR hue; weak very coarse prismatic structure parting to weak medium subangular blocky; hard and very hard, very friable; few carbonate filaments; a few discontinuous, roughly vertical carbonate bands, commonly about 2 cm in diameter, ranging from 1 to 3 cm in diameter; the bands occurring as joint fillings between prisms; few carbonate nodules; 5YR parts noncalcareous or slightly effervescent and 6YR parts strongly effervescent; clear wavy boundary.

Btk5—81 to 96 cm; light reddish brown (6YR 6.5/4) loamy sand, reddish brown (6YR 5/4) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; hard and very hard, very friable; few carbonate filaments; a few discontinuous, roughly vertical carbonate bands, commonly about 2 cm in diameter, ranging from 1 to 3 cm in diameter; the bands occurring as joint fillings between prisms; few carbonate nodules; strongly effervescent; clear wavy boundary.

BCtk1—96 to 114 cm; light reddish brown (6YR 6.5/4) loamy sand, reddish brown (6YR 5/4) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; slightly hard and hard, very friable; few carbonate filaments; a few discontinuous, roughly vertical carbonate bands, commonly about 2 cm in diameter, ranging from 1 to 3 cm in diameter; the bands occurring as joint fillings between prisms; few carbonate nodules; strongly effervescent; clear wavy boundary.

BCtk2—114 to 132 cm; light brown (7.5YR 6.5/4) loamy sand, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; most carbonate bands terminate above, but two penetrate this and the underlying horizon; some parts noncalcareous, some slightly effervescent, and some strongly effervescent; clear wavy boundary.

Bk1b—132 to 149 cm; pinkish white (7.5YR 8/2) loamy sand, light brown (7.5YR 6/4) moist; weak coarse subangular blocky structure; very hard, friable; two carbonate bands ending in this horizon; strongly effervescent; clear wavy boundary.

Bk2b—149 to 168 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5/3) moist; weak medium subangular blocky structure; hard and very hard, very friable; strongly effervescent.

Soil series: Sonoita. Classification: Coarse-loamy, mixed, superactive, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-003 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 92P 157, (RP92NM235) GLOBAL WARMING
- PEDON 92P 836, SAMPLES 92P 5165-5176
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- -				- - - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
92P5165S	0- 5	A	13.0	8.7	78.3			3.1	5.6	15.3	29.6	24.8	7.0	1.6	1	3	--	64	4
92P5166S	5- 8	BAtk1	12.2	7.5	80.3			3.6	3.9	15.2	26.6	28.4	8.8	1.3	1	1	--	66	2
92P5167S	8- 17	BAtk2	13.5	6.7	79.8		1.5	3.3	3.4	14.9	29.0	26.6	7.8	1.5	1	1	--	66	2
92P5168S	17- 33	Btk1	14.0	6.8	79.2		1.2	2.6	4.2	15.4	27.5	26.9	7.8	1.6	2	1	--	65	3
92P5169S	33- 46	Btk2	14.5	5.8	79.7		1.8	2.3	3.5	11.7	28.4	27.6	8.9	3.1	1	2	--	69	3
92P5170S	46- 65	Btk3	12.8	6.0	81.2		1.5	2.0	4.0	14.0	28.9	28.7	7.8	1.8	1	1	--	68	2
92P5171S	65- 81	Btk4	11.0	6.1	82.9		1.5	2.5	3.6	16.3	32.2	26.2	6.9	1.3	1	TR	--	67	1
92P5172S	81- 96	Btk5	9.0	5.6	85.4		0.3	2.2	3.4	15.1	30.3	29.8	8.2	2.0	1	1	--	71	2
92P5173S	96-114	BCtk1	7.5	6.4	86.1		1.2	2.1	4.3	13.0	35.7	28.4	7.0	2.0	2	1	--	74	3
92P5174S	114-132	BCtk2	6.3	5.5	88.2		0.6	1.3	4.2	14.9	35.5	28.3	7.3	2.2	2	2	--	74	4
92P5175G	132-149	Bk1b	7.7	7.1	85.2		3.3	2.9	4.2	11.4	30.9	28.1	10.6	4.2					P
92P5176G	149-168	Bk2b	6.5	6.6	86.9		1.2	2.9	3.7	11.5	30.6	31.4	11.4	2.0					P

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 5	0.20							0.82	0.33										4.3	
5- 8	0.19							0.86	0.39										4.7	
8- 17	0.12							0.70	0.36										4.8	
17- 33	0.12							0.71	0.39										5.5	
33- 46	0.13							0.71	0.45										6.5	
46- 65	0.08							0.79	0.45										5.7	
65- 81	0.08							0.74	0.47										5.2	
81- 96	0.08							0.76	0.46										4.1	
96-114	0.03							0.67	0.48										3.6	
114-132	0.04							0.67	0.56										3.5	
132-149	0.05							0.56	0.49										3.8	
149-168								0.62	0.52										3.4	

AVERAGES, DEPTH 25-100: PCT CLAY 11 PCT .1-75MM 68

Soil series: Sonoita. Classification: Coarse-loamy, mixed, superactive, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-003 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 92P 836, SAMPLE 92P 5165-5176

DEPTH (CM)	-1- CA 5B5a 6N2e	-2- MG 5B5a 6O2d	-3- NA 5B5a 6P2b	-4- K 5B5a 6Q2b	-5- SUM BASES	-6- ACIDITY 6H5a	-7-	-8- SUM CATS 5A3a	-9- NH4-OAC 5A8b	-10- EXCH NA 5D2 PCT	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1g	-15- CARBONATE AS CACO3 <20MM 6E4	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f 1:2	-20- PH H2O 8C1f 1:1
	<- - -	- - -	- - -	- - -	-MEQ / 100	G - - -	- - -	- - -	- - ->	PCT		<- -PCT-	>	<- -PCT	->	<- -PCT	->			
0- 5	13.2	1.2	0.1	0.5	15.0	--		15.0	10.7	1		100	100	TR					7.7	8.3
5- 8		1.2	0.1	0.5					10.5	1		100	100	1					7.8	8.5
8- 17		1.4	0.1	0.3					9.5	1		100	100	3					7.8	8.3
17- 33		2.1	0.1	0.2					9.9	1		100	100	2					7.7	8.3
33- 46		2.7	0.3	0.4					10.3	3		100	100	3					7.8	8.4
46- 65		3.1	0.4	0.3					10.1	4		100	100	2					7.8	8.5
65- 81		2.9	0.7	0.2					8.1	5	3	100	100	3		TR		7.8	7.8	8.1
81- 96		2.8	0.8	0.2					6.8	8	3	100	100	3		TR		7.8	7.8	8.1
96-114		2.4	0.7	0.1					5.0	9	4	100	100	2				8.0	7.9	8.3
114-132		2.0	0.7	0.2					4.2	12	5	100	100	1				8.3	7.9	8.5
132-149		2.0	0.9	0.2					4.3	15	7	100	100	5				8.2	7.9	8.7
149-168		1.8	0.9	0.2					4.0	17	9	100	100	4				8.4	7.9	8.9

DEPTH (CM)	(- - - WATER EXTRACTED FROM SATURATED PASTE- - -) CA 6N1b	MG 6O1b	NA 6P1b	K 6Q1b	CO3 6I1b	HCO3 6J1b	F 6U1a	CL 6K1c	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1c	NO2 6W1a	NO3 6M1c	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - -	- - -	- - -	- - -	- - -	- - -	MEQ /	LITER - - -	- - -	- - -	- - -	- - -	- - -	- - ->	<- -PCT-	->		
0- 5																		0.16
5- 8																		0.13
8- 17																		0.15
17- 33																		0.15
33- 46																		0.16
46- 65																		0.18
65- 81	12.8	4.1	7.7	0.2	--	2.1		0.7				22.6		--	34.0	TR	1.92	0.58
81- 96	13.1	4.4	9.7	0.2	--	1.3		1.3				23.6		--	26.1	TR	2.15	0.62
96-114	7.0	2.8	9.5	0.1	--	1.9	TR	4.5				11.2		--	24.8	TR	1.71	0.42
114-132	2.3	1.0	6.4	0.1	--	1.9	0.3	2.5				4.7		--	26.1	TR	0.95	0.34
132-149	2.0	1.0	8.9	0.1	--	2.3	0.3	3.4				5.0		--	26.2	TR	1.16	0.34
149-168	1.1	0.6	8.0	0.1	--	3.1	0.5	3.1				2.5		--	24.9	TR	0.96	0.28

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS G= <2mm ON GROUND <75mm BASIS P= FABRIC ON <75mm FRACTION

Soil series: Lacita, buried soil analog
Classification: Fine-silty, mixed, superactive, calcareous, thermic Ustic Torriorthent
Soil survey number: S92NM-013-004
Location: NE1/4NE1/4NE1/4 sec. 30, T. 21 S., R. 2 E., 120 m west of Holman Road
Elevation: 4,380 feet, 1,335 m
Landform: Scarplet along dissected fan piedmont
Geomorphic surface: Organ
Parent material: Organ alluvium derived from limestone, calcareous sandstone and siltstone, and mixed igneous rocks
Vegetation: Creosotebush, tarbush, burrograss, tobosa
Described and sampled by: L.H. Gile
Date: April 20, 1992

A—0 to 5 cm; light brownish gray (10YR 6/2) loam, dark brownish gray (10YR 4/2) moist; moderate thin and medium platy structure; very hard, friable; few very fine roots; strongly effervescent; clear wavy boundary.

Bw1—5 to 17 cm; light brownish gray (10YR 6.5/2) clay loam, dark brownish gray (10YR 4/2) moist; weak medium subangular blocky structure; very hard, friable; few very fine roots; strongly effervescent; clear wavy boundary.

Bw2—17 to 31 cm; light gray (10YR 7/2) silty clay loam, brown (10YR 4.5/3) moist; weak and moderate fine subangular blocky structure; very hard, friable; few very fine roots; strongly effervescent; clear wavy boundary.

Bw3—31 to 46 cm; light brownish gray (10YR 6.5/2) silty clay loam, brown (10YR 4.5/3) moist; weak and moderate fine and medium subangular blocky structure; very hard, friable; few very fine roots; strongly effervescent; clear wavy boundary.

Bw4—46 to 58 cm; light brownish gray (10YR 6.5/2) clay loam, brown (10YR 4.5/3) moist; weak and moderate fine and medium subangular blocky structure; very hard, friable; few very fine roots; strongly effervescent; clear wavy boundary.

Bwk1b—58 to 67 cm; pinkish gray to light brown (7.5YR 6.5/3) sandy clay loam, brown to dark brown (7/5YR 4.5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few very fine roots; scattered pebbles in the lower 1 to 2 cm, included in sample; most pebbles are 1 to 2 cm thick, ranging up to 4 cm thick in a few places; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; abrupt smooth boundary.

Bwk2b—67 to 78 cm; pinkish gray to light brown (7.5YR 6.5/3) sandy clay loam, brown to dark brown (7/5YR 4.5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few very fine roots; scattered pebbles in the lower 1 to 2 cm, included in sample; most pebbles are 1 to 2 cm thick, ranging up to 4 cm thick in a few places; thin, discontinuous carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.

Btkb2—78 to 93 cm; light reddish brown (6YR 6/4) clay loam, reddish brown (6YR 4.5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; few very fine roots; strongly effervescent; abrupt smooth boundary.

K1b2—93 to 111 cm; pinkish white (7.5YR 8/2) clay, pinkish gray (7.5YR 7/2) moist; weak fine and medium subangular blocky structure; very hard; firm; very few fine roots; a lesser amount 7.5YR 6.5/3 dry, 4.5/3 moist; strongly effervescent; clear wavy boundary.

K2b2—111 to 127 cm; pinkish white (7.5YR 8/2) clay, pinkish gray to pink (7.5YR 7/3) moist; weak fine and medium subangular blocky structure; very hard; firm; very few fine roots; a lesser amount 7.5YR 6.5/3 dry, 4.5/3 moist; strongly effervescent.

Soil series: Lacita, buried soil analog. Classification: Fine-silty, mixed, superactive, calcareous, thermic Ustic Torriorthent.

***P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-004 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 92P 837, SAMPLE 92P 5177-5186

DEPTH (CM)	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-ITY		(- -CEC- -)		EXCH NA	SAR	BASE SATURATION		CARBONATE AS CACO3		CASO4 AS GYPSUM		(- - - -PH - - -)		
	CA	MG	NA	K	SUM BASES			SUM CATS	NH4-OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	SAT PASTE	CACL2 .01M	H2O
	5B5a 6N2e	5B5a 6O2d	5B5a 6P2b	5B5a 6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f 1:2	8C1f 1:1
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->				
0- 5		2.8	TR	1.8					19.3	TR	TR	100	100	18		TR		7.7	7.6	8.0
5- 17		3.1	0.1	1.7					20.3	TR	TR	100	100	19				7.7	7.7	8.2
17- 31		3.4	0.1	1.4					19.5	1	TR	100	100	29		TR		7.5	7.6	7.9
31- 46		3.6	0.1	1.2					17.6	1	TR	100	100	28		TR		7.5	7.6	7.9
46- 58		3.1	0.1	0.9					12.4	1	TR	100	100	20		TR		7.5	7.6	7.9
58- 67		2.7	0.1	0.6					9.6	1	TR	100	100	15				7.6	7.6	7.9
67- 78		3.2	0.1	0.6					10.6	1	TR	100	100	15				7.7	7.7	8.0
78- 93		4.8	0.1	1.1					15.1	1	TR	100	100	16				7.7	7.6	7.9
93-111		4.6	0.1	0.7					9.8	1	TR	100	100	51				7.8	7.7	8.2
111-127		5.2	0.1	0.5					8.0	2	TR	100	100	57				7.9	7.7	8.3

DEPTH (CM)	(- - - - WATER EXTRACTED FROM SATURATED PASTE- - - -)																	PRED.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	TOTAL SALTS EST.	ELEC. COND.	ELEC. COND.
	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	8A3a	8I
	<- - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		MMHOS /cm	MMHOS /cm
0- 5	6.0	1.1	0.6	0.9	--	7.4		0.5				0.7		--	52.3	TR	0.92	0.50
5- 17	4.9	0.9	0.6	0.6	--	4.8		0.5				1.2		--	38.5	TR	0.61	0.30
17- 31	11.2	1.9	0.7	0.6	--	2.5		0.6				8.1	2.2	--	51.3	TR	1.23	0.57
31- 46	12.5	2.4	0.7	0.5	--	2.4		0.8				8.1	0.3	3.4	53.6	TR	1.38	0.67
46- 58	18.1	3.8	1.2	0.6	--	2.6		2.4				5.4	1.0	11.0	33.1	TR	2.03	0.61
58- 67	9.9	2.5	1.2	0.6	--	1.6		2.3				0.9	1.2	6.9	29.3	TR	1.42	0.38
67- 78	9.6	2.7	0.5	0.3	--	1.5		1.4				1.0	0.3	8.1	30.8	TR	1.32	0.36
78- 93	7.0	2.4	0.6	0.3	--	1.2		1.3				1.0	0.3	5.9	40.0	TR	1.04	0.39
93-111	3.3	1.5	0.4	0.3	--	2.5		0.4				1.5	0.3	0.5	43.0	TR	0.53	0.26
111-127	2.3	1.3	0.5	0.2	--	2.5		0.2				1.1		0.2	42.7	TR	0.41	0.32

ANALYSES: S= ALL ON SIEVED <2mm BASIS G= <2mm ON GROUND <75mm BASIS P= FABRIC ON <75mm FRACTION

Soil series: Reagan
Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid
Soil survey number: S92NM-013-005
Location: NE$^1/_4$SW$^1/_4$SW$^1/_4$ sec. 19, T. 21 S., R. 3 E., 750 feet (225 m) east of Holman Road
Elevation: 4,395 feet, 1,340 m
Landform: Scarplet cut in coalescent fan piedmont sloping 1 percent west
Geomorphic surface: Organ
Parent material: Organ fan piedmont alluvium derived from limestone, calcareous sandstone and siltstone, and mixed igneous rocks
Vegetation: Creosotebush, tarbush, burrograss
Described and sampled by: Clarence Montoya
Date: May 18, 1992

A—0 to 7 cm; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate thin platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; violently effervescent; abrupt smooth boundary.
Bk1—7 to 13 cm; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; abrupt smooth boundary.
Bk2—13 to 22 cm; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; abrupt smooth boundary.
Bk3—22 to 34 cm; dark yellowish brown (10YR 4/6) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; abrupt smooth boundary.
Bk4—34 to 44 cm; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; abrupt smooth boundary.
Bk5—44 to 53 cm; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; abrupt smooth boundary.
Bk6—53 to 64 cm; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; clear smooth boundary.
Bk7—64 to 94 cm; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; few fine irregular carbonate threads; violently effervescent; clear smooth boundary.
Bk1b—94 to 123 cm; brown (7.5YR 4/4) silty clay loam, pink (7.5YR 7/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; violently effervescent; clear smooth boundary.
Bk2b—123 to 145 cm; brown (7.5YR 4/4) clay loam, pink (7.5YR 7/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; few fine irregular carbonate threads; violently effervescent; gradual smooth boundary.
Bk3b—145 to 187 cm; strong brown (7.5YR 5/6) clay loam, pink (7.5YR 7/4) dry; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine irregular carbonate threads; violently effervescent; gradual wavy boundary.
Bk4b—187 to 214 cm; strong brown (7.5YR 5/6) clay loam, pink (7.5YR 7/4) dry; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine irregular carbonate threads; violently effervescent.

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-005 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 92P 114, (CP92NM179) SW NM II
- PEDON 92P 653, SAMPLES 92P 3925-3936
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -	- - - - -)			(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - -	- ->		<- PCT OF	<75MM(3B1)	->		SOIL
92P3925S	0- 7	A	26.6	56.2	17.2	2.3	6.9	45.7	10.5	11.1	4.9	0.7	0.4	0.1	--	--	--	6	--
92P3926S	7- 13	Bk1	35.0	48.3	16.7	2.4	9.4	42.3	6.0	10.4	5.1	0.8	0.4	TR	--	--	--	6	--
92P3927S	13- 22	Bk2	35.0	53.7	11.3	2.7	8.1	46.5	7.2	7.4	3.1	0.6	0.2	TR	--	--	--	4	--
92P3928S	22- 34	Bk3	29.6	56.6	13.8	3.1	8.1	47.7	8.9	9.7	3.3	0.5	0.2	0.1	--	--	--	4	--
92P3929S	34- 44	Bk4	31.8	55.9	12.3	2.9	8.1	46.1	9.8	9.0	2.8	0.4	0.1	--	--	--	--	3	--
92P3930S	44- 53	Bk5	33.8	57.2	9.0	3.5	9.1	47.4	9.8	6.9	1.5	0.3	0.2	0.1	--	--	--	2	--
92P3931S	53- 64	Bk6	33.2	54.2	12.6	5.3	8.7	42.6	11.6	8.9	3.0	0.5	0.2	TR	--	1	--	5	1
92P3932S	64- 94	Bk7	33.7	55.5	10.8	6.0	10.2	47.4	8.1	7.0	2.9	0.6	0.3	--	--	--	--	4	--
92P3933S	94-123	Bk1b	32.0	49.7	18.3	5.8	8.1	42.1	7.6	9.3	6.6	1.4	0.6	0.4	--	TR	--	9	--
92P3934S	123-145	Bk2b	31.4	31.1	37.5	5.9	8.0	24.3	6.8	14.1	14.1	4.4	3.0	1.9	2	3	2	29	7
92P3935S	145-187	Bk3b	33.8	34.3	31.9	9.4	13.0	24.5	9.8	14.6	10.6	3.0	2.1	1.6	2	1	--	20	3
92P3936S	187-214	Bk4b	30.0	35.8	34.2	8.6	8.3	24.8	11.0	16.1	11.4	3.4	2.0	1.3	3	6	--	25	9

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B3a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A3a	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF	<2MM	- ->		CM/CM
0- 7	1.04							0.71	0.50	30	9		1.24	1.32	0.021			28.3	13.4	0.18
7- 13	0.94							0.58	0.45	31	9		1.27	1.36	0.023			27.0	15.7	0.14
13- 22	0.92							0.57	0.44				1.26	1.31	0.013			25.9	15.5	0.13
22- 34	0.76							0.64	0.48	29	9		1.38	1.40	0.005			25.1	14.2	0.15
34- 44	0.74							0.61	0.46				1.32	1.37	0.012			26.5	14.7	0.16
44- 53	0.82							0.59	0.45	31	11		1.29	1.36	0.018			26.8	15.2	0.15
53- 64	0.63							0.52	0.43				1.28	1.34	0.015			27.0	14.4	0.16
64- 94	0.51							0.50	0.41	32	14		1.26	1.49	0.057			27.7	13.9	0.17
94-123	0.32							0.52	0.43				1.47	1.56	0.015			17.3	13.7	0.05
123-145	0.23							0.46	0.35	27	13		1.48	1.63	0.031			18.3	10.9	0.11
145-187	0.18							0.34	0.33				1.33	1.43	0.024			22.1	11.0	0.15
187-214	0.17							0.43	0.36	29	16		1.29	1.38	0.021			23.6	10.7	0.16

AVERAGES, DEPTH 25-100: PCT CLAY 24 PCT .1-75MM 4

Soil series: Reagan. Classification: Fine-silty, mixed, superactive, thermic Ustic Haplocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S92NM-013-005 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 92P 653, SAMPLE 92P 3925-3936

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 7		2.5	TR	1.4					19.0	TR	TR	100	100	23				7.6	7.6	8.1
7- 13		3.1		1.5					20.2		TR	100	100	25				7.6	7.6	8.1
13- 22		2.7		1.4					20.0		TR	100	100	25				7.6	7.6	8.1
22- 34		3.2	TR	1.2					19.0	TR	TR	100	100	25				7.8	7.6	8.1
34- 44		3.3	0.1	1.2					19.5	1	1	100	100	23				7.7	7.6	8.1
44- 53		3.5	0.3	1.1					19.8	1	1	100	100	24				7.6	7.6	8.0
53- 64		3.5	0.3	1.2					17.4	1	1	100	100	26				7.6	7.6	8.0
64- 94		4.3	0.6	1.1					17.0	2	1	100	100	27				7.5	7.6	7.7
94-123		5.0	0.7	1.3					16.7	2	2	100	100	22				7.5	7.6	7.7
123-145		4.7	0.5	0.9					14.3	2	2	100	100	18				7.5	7.6	7.7
145-187		4.8	0.6	0.5					11.6	3	2	100	100	30				7.5	7.6	7.8
187-214		5.4	0.7	0.5					12.9	3	2	100	100	29				7.6	7.7	7.9

	(- - - - WATER EXTRACTED FROM SATURATED PASTE- - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 7	4.1	0.6	0.3	0.3		4.0	TR	0.2				0.5	0.3	TR	41.5	TR	0.49	0.31
7- 13	4.7	0.6	0.7	0.2		3.9	0.1	0.7				0.7	0.5	--	40.8	TR	0.60	0.29
13- 22	5.1	0.7	0.6	0.3		3.8	0.1	0.5				1.0	0.9	--	43.5	TR	0.62	0.30
22- 34	5.2	0.8	0.6	0.3		3.4	TR	0.5				0.6	1.3	0.8	46.8	TR	0.67	0.31
34- 44	5.8	1.0	1.0	0.3		3.0	TR	0.9				0.8	1.1	1.6	47.3	TR	0.79	0.34
44- 53	6.5	1.2	1.6	0.4		2.8	--	2.0				1.2	0.9	1.9	48.3	TR	0.93	0.40
53- 64	7.7	1.6	2.7	0.3		2.4	--	4.6				2.1	1.1	1.0	43.7	TR	1.22	0.46
64- 94	19.8	4.4	5.0	0.5		2.0	--	12.7				6.5	--	6.3	52.6	0.1	2.65	1.00
94-123	30.6	8.7	7.1	0.6		1.3	--	21.8				8.0	--	12.5	49.3	0.2	4.13	1.35
123-145	19.8	6.6	5.6	0.4		1.0	TR	16.1				4.1	--	9.2	39.5	0.1	3.03	0.87
145-187	14.4	6.2	6.5	0.3		1.0	TR	16.2				--	--	8.3	41.2	0.1	2.73	0.86
187-214	10.2	4.6	6.1	0.3		1.1	TR	11.3				2.8	--	5.4	37.9	0.1	2.05	0.69

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: University
Classification: Mixed, thermic Typic Torripsamment
Soil survey number: S93NM-013-001
Location: SW1/4NW1/4SW1/4 sec. 35, T. 20 S., R. 1 W., 10 m east of road
Elevation: 4,300 feet, 1,311 m
Landform: Ridge side sloping 6 percent south
Geomorphic surface: Fort Selden
Parent material: Colluvial-alluvial sediments, mainly noncalcareous sand with a few fine rounded pebbles of mixed igneous lithology and a few fine carbonate-cemented fragments
Vegetation: Dropseed, Mormon tea, soaptree yucca, mesquite, snakeweed
Described and sampled by: L.H. Gile
Date: January 29, 1993

A1—0 to 4 cm; pinkish gray (7.5YR 6/2) sand, brown to dark brown (7.5YR 4/2) moist; massive and single grain; soft and loose, very friable, nonsticky and nonplastic; noncalcareous; abrupt smooth boundary.
A2—4 to 25 cm; brown (7.5YR 5/2) sand, dark brown (7.5YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; noncalcareous; clear wavy boundary.
A3—25 to 42 cm; brown (7.5YR 5/2) sand, dark brown (7.5YR 3.5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; slightly effervescent; clear wavy boundary.
Ck1—42 to 67 cm; pinkish gray to light brown (7.5YR 6.5/3) fine sand, brown (7.5YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.
Ck2—67 to 87 cm; pinkish gray (8YR 6.5/2) fine sand, brown (8YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.
Ck3—87 to 112 cm; light gray (9YR 7/2) fine sand, grayish brown (9YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.
C1—112 to 134 cm; light gray (10YR 7.5/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; some parts slightly effervescent and other parts strongly effervescent; clear wavy boundary.
C2—134 to 167 cm; light gray (10YR 7.5/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; some parts slightly effervescent and other parts strongly effervescent.

Soil series: University. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S93NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 93P 78, (RP93NM120) GLOBAL WARMING
- PEDON 93P 450, SAMPLES 93P 3389-3396
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON		LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
93P3389S	0- 4	A1		5.1	2.7	92.2			0.3	2.4	5.9	30.4	42.0	12.8	1.1	TR	TR	--	86	TR
93P3390S	4- 25	A2		5.7	3.4	90.9			1.3	2.1	5.2	32.7	36.1	14.2	2.7	2	TR	--	86	2
93P3391S	25- 42	A3		5.4	3.2	91.4			1.2	2.0	5.4	32.1	37.2	14.9	1.8	1	TR	--	86	1
93P3392S	42- 67	Ck1		5.8	3.4	90.8			1.6	1.8	7.6	39.1	32.0	10.6	1.5	1	TR	--	83	1
93P3393S	67- 87	Ck2		6.0	3.8	90.2		0.6	1.9	1.9	6.4	41.8	32.0	8.1	1.9	1	1	--	84	2
93P3394S	87-112	Ck3		5.0	2.4	92.6		0.3	1.5	0.9	5.7	48.2	28.7	8.9	1.1	1	2	--	87	3
93P3395S	112-134	C1		3.3	1.7	95.0		0.9	0.7	1.0	5.0	53.3	29.0	6.3	1.4	1	1	--	90	2
93P3396S	134-167	C2		3.7	1.6	94.7			0.8	0.8	7.4	58.7	24.7	3.3	0.6	TR	1	--	87	1

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 4	0.15								0.33										1.7	
4- 25	0.18								0.42										2.4	
25- 42	0.10								0.41										2.2	
42- 67	0.09								0.43										2.5	
67- 87	0.06								0.45										2.7	
87-112	0.04								0.48										2.4	
112-134	0.01								0.64										2.1	
134-167	0.01								0.38										1.4	

AVERAGES, DEPTH 25-100: PCT CLAY 5 PCT .1-75MM 85

Soil series: University. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S93NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 93P 450, SAMPLE 93P 3389-3396

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE	SAT-	CO3 AS	RES.		COND.	(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9c	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - - ->								1:2	1:1
0- 4														TR					7.1	7.7
4- 25														TR					7.6	8.3
25- 42														TR					7.8	8.5
42- 67														2					7.9	8.5
67- 87														3					7.9	8.6
87-112														2					7.9	8.6
112-134														1					7.9	8.7
134-167														1					7.9	8.6

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: University
Classification: Mixed, thermic Typic Torripsamment
Soil survey number: S93NM-013-002
Location: SW1/4SW1/4NW1/4 sec. 35, T. 20 S., R. 1 W., 20 m east of road
Elevation: 4,320 feet, 1,317 m
Landform: Ridge side sloping 6 percent north
Geomorphic surface: Fort Selden
Parent material: Colluvial-alluvial sediments, mainly noncalcareous sand with a few fine rounded pebbles of mixed igneous lithology and a few fine carbonate-cemented fragments
Vegetation: Dropseed, fluffgrass, soaptree yucca, snakeweed, Mormon tea, mesquite
Described and sampled by: L.H. Gile
Date: February 3, 1993

A1—0 to 4 cm; brown (7.5YR 5.5/2) sand, dark brown (7.5YR 3.5/2) moist; massive and single grain; soft and loose, very friable, nonsticky and nonplastic; noncalcareous; abrupt smooth boundary.

A2—4 to 18 cm; brown (7.5YR 5.5/2) sand, dark brown (7.5YR 3.5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; noncalcareous; clear wavy boundary.

A3—18 to 33 cm; brown (7.5YR 5/2) sand, dark brown (7.5YR 3.5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; noncalcareous; clear wavy boundary.

Ck1—33 to 48 cm; brown (7.5YR 5.5/2) sand, brown to dark brown (7.5YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Ck2—48 to 76 cm; pinkish gray (8YR 6.5/2) sand, brown (8YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

Ck3—76 to 99 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; thin, discontinuous carbonate coatings on sand grains and pebbles; strongly effervescent; clear wavy boundary.

C—99 to 110 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; massive and single grain; soft, loose, very friable, nonsticky and nonplastic; very few fine and very fine roots; very few fine pebbles and carbonate-cemented fragments; noncalcareous, slightly effervescent.

Soil series: University. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S93NM-013-002 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 93P 78, (RP93NM120) GLOBAL WARMING
- PEDON 93P 451, SAMPLES 93P 3397-3403
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL		- - -)	(- -CLAY-	-)	(- -SILT-	-)	(- - - -		- -SAND- -		- - - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
93P3397S	0- 4	A1	4.4	3.3	92.3			1.3	2.0	3.9	23.4	42.3	17.0	5.7	1	2	--	89	3
93P3398S	4- 18	A2	5.6	4.9	89.5			1.6	3.3	6.3	30.8	37.5	12.3	2.6	1	1	--	84	2
93P3399S	18- 33	A3	4.3	3.0	92.7		0.3	1.4	1.6	3.4	21.3	42.1	21.2	4.7	1	1	--	90	2
93P3400S	33- 48	Ck1	5.0	3.1	91.9		0.3	1.5	1.6	4.0	25.3	41.6	16.2	4.8	1	1	--	88	2
93P3401S	48- 76	Ck2	5.3	4.0	90.7			1.8	2.2	5.1	29.6	38.3	13.8	3.9	1	1	--	86	2
93P3402S	76- 99	Ck3	3.0	1.7	95.3		0.6	1.5	0.2	2.4	22.8	39.3	22.1	8.7	4	3	--	93	7
93P3403S	99-110	C	2.0	0.7	97.3			0.4	0.3	1.1	14.3	54.4	22.2	5.3	2	2	--	96	4

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT		- -)		WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM —>						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 4	0.22								0.43										1.9	
4- 18	0.13								0.39										2.2	
18- 33	0.12								0.51										2.2	
33- 48	0.12								0.40										2.0	
48- 76	0.10								0.45										2.4	
76- 99	0.03								0.63										1.9	
99-110	0.02								0.50										1.0	

AVERAGES, DEPTH 25-100: PCT CLAY 4 PCT .1-75MM 89

Soil series: University. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S93NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 93P 451, SAMPLE 93P 3397-3403

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE	SAT-	CO3 AS	RES.		COND.	(- - - -PH - - -)		
DEPTH	CA	MG	NA	K	SUM BASES	ITY	AL	SUM CATS	NH4-OAC	BASES + AL	SAT	SUM	NH4 OAC	CACO3 <2MM	OHMS /CM		MMHOS /CM		CACL2 .01M	H2O
(CM)	5B5a 6N2e	5B5a 6O2d	5B5a 6P2b	5B5a 6Q2b		6H5a	6G9c	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f 1:2	8C1f 1:1
	<- - - - - - - - - -	-MEQ / 100 G	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - ->	<- - - - -	- - -PCT	- - - -	- - ->						
0- 4														TR					7.2	7.9
4- 18														TR					7.6	8.3
18- 33														TR					7.8	8.5
33- 48														1					7.9	8.6
48- 76														3					7.9	8.6
76- 99														2					8.0	8.7
99-110														TR					8.0	8.8

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Cruces, overblown phase
Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid
Soil survey number: S94NM-013-001
Location: SW1/4NE1/4SE1/4 sec. 4, T. 18 S., R. 1 E., 48 m west of road and 14 m northwest of pedon S94NM-013-002
Elevation: 4,365 feet, 1,330 m
Landform: North-facing side of a gentle ridge on an undulating basin floor; slope of 2 percent
Geomorphic surface: La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mostly barren; sparse snakeweed and fluffgrass
Described and sampled by: L.H. Gile
Date: December 6, 1993

C—0 to 10 cm; reddish brown (5YR 5.5/4) sand, reddish brown (5YR 4/4) moist; stratified; massive, with horizontal cleavage; slightly hard, very friable; generally slightly effervescent, a few spots noncalcareous; abrupt smooth boundary.

BAtb—10 to 16 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable; few very fine roots; sand grains coated with oriented clay; strongly effervescent; clear wavy boundary.

Btk1b—16 to 26 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; insect burrows, 2 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; few carbonate filaments; sand grains coated with oriented clay; strongly effervescent; clear wavy boundary.

Btk2b—26 to 36 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; weak medium and coarse subangular blocky structure; hard and very hard, friable; very few very fine roots; few carbonate filaments; sand grains coated with oriented clay; insect burrows, 2 to 10 mm in diameter, some empty and some filled or partly filled with fine earth; strongly effervescent; clear wavy boundary.

Btk3b—36 to 42 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; very few very fine roots; few carbonate filaments; sand grains coated with oriented clay; strongly effervescent; abrupt smooth boundary.

K1b—42 to 51 cm; pinkish white (7.5YR 9/2) calcrete gravel with virtually no fine earth; pinkish white (7.5YR 8/2) moist; single grain; extremely hard; very few very fine roots; gravel thinly coated with fine earth colored 5YR 7/4 dry; strongly effervescent; abrupt smooth boundary.

K21mb—51 to 61 cm; consisting of an indurated laminar horizon colored 7.5YR 8/1 dry, 7.5YR 7/3 moist, with some darker parts, and an attached plugged horizon, colored 7.5YR 8 3 dry, 7.5YR 7/3 moist; thin crack fillings colored 7.5YR 9/1 dry; massive; extremely hard; strongly effervescent; clear wavy boundary.

K22mb—61 to 72 cm; pinkish white to pink (7.5YR 9/3) carbonate-cemented material, pinkish white to pink (7.5YR 8/3) moist; massive; extremely hard; strongly effervescent; clear wavy boundary.

K23mb—72 to 88 cm; pinkish white (7.5YR 9/2) carbonate-cemented material, pinkish white (7.5YR 8/2) moist; massive; extremely hard; strongly effervescent; clear wavy boundary.

K24mb—88 to 104 cm; pinkish white (7.5YR 9/2) carbonate-cemented material, pinkish white (7.5YR 8/2) moist; massive; extremely hard; very few parts of Bt material, 5YR 5/4 dry, mostly noncalcareous and from 1 to 10 mm in diameter; strongly effervescent; clear wavy boundary.

K25b—104 to 122 cm; pinkish white (7.5YR 9/2) carbonate-cemented material, pinkish white (7.5YR 8/2) moist; weak coarse subangular blocky structure; extremely hard; very few parts of Bt material, 5YR 5/4 dry, mostly noncalcareous and from 1 to 10 mm in diameter; strongly effervescent; clear wavy boundary.

K26mb—122 to 150 cm; pinkish white (7.5YR 9/2) carbonate-cemented material, pinkish white (7.5YR 8/2) moist; weak coarse subangular blocky structure; extremely hard; strongly effervescent; clear wavy boundary.

K27b—150 to 173 cm; pinkish white (7.5YR 8/2) carbonate-cemented material, pinkish gray to pink (7.5YR 7/3) moist; weak coarse subangular blocky structure; extremely hard; very few very fine roots; strongly effervescent; clear wavy boundary.

K28b—173 to 195 cm; pinkish white (7.5YR 8/2) very gravelly loamy sand, pinkish gray to pink (7.5YR 7/3) moist; single grain and weak coarse subangular blocky structure; extremely hard; very few very fine roots; gravel consisting of carbonate-cemented blocks; strongly effervescent; abrupt wavy boundary.

K29mb—195 to 212 cm; pinkish white (7.5YR 9/2) carbonate-cemented material, pinkish white (7.5YR 8/2) moist; massive; extremely hard; strongly effervescent; clear wavy boundary.

K31b—212 to 230 cm; white (10YR 9/2) carbonate-cemented material, white (10YR 8/2) moist; weak coarse subangular blocky structure; extremely hard; strongly effervescent; clear wavy boundary.

K32b—230 to 253 cm; very pale brown (10YR 9/3) very gravelly loamy sand, very pale brown (10YR 8/3) moist; weak medium and coarse subangular blocky structure; extremely hard; gravel consisting of carbonate-cemented blocks; strongly effervescent; clear wavy boundary.

K33b—253 to 302 cm; white (10YR 9/2) very gravelly sand, white (10YR 8/2) moist; weak medium and coarse subangular blocky structure; extremely hard; gravel consisting of carbonate-cemented blocks; strongly effervescent; clear wavy boundary.

C—302 to 322 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; massive; soft; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Ck—322 to 352 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; massive; soft; some parts slightly effervescent and other parts noncalcareous.

Soil series: Cruces, overblown phase. Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 94P 63, (RP94NM124) JORNADA EXP.
- PEDON 94P 349, SAMPLES 94P 2130-2149
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -	-)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - - -	- - - -	->	<- PCT OF	<75MM(3B1)		->	SOIL
94P2130S	0- 10	C	5.0	4.7	90.3			1.0	3.7	10.7	48.2	28.5	2.8	0.1	TR	--	--	80	--
94P2131S	10- 16	BAtb	12.0	8.0	80.0		1.8	1.7	6.3	10.7	35.3	29.3	4.4	0.3	TR	TR	--	69	TRK
94P2132S	16- 26	Btk1b	14.0	10.2	75.8		2.1	2.3	8.0	12.1	32.1	26.4	4.9	0.3	TR	TR	--	64	TRK
94P2133S	26- 36	Btk2b	17.1	11.0	71.9		2.6	2.6	8.4	13.2	32.4	21.6	3.8	0.9	TR	TR	--	59	TRK
94P2134S	36- 42	Btk3b	16.6	9.1	74.3		1.8	2.0	7.1	12.2	35.7	21.5	3.8	1.1	1	1	--	63	2K
94P2135N	42- 51	K1b	15.6	10.9	73.5		2.6	4.2	6.7	11.6	30.0	20.8	5.8	5.3					K
94P2136N	51- 61	K21mb	10.1	13.5	76.4		6.2	7.6	5.9	9.6	22.7	20.2	11.4	12.5					K
94P2137N	61- 72	K22mb	10.3	14.2	75.5		8.1	8.0	6.2	9.1	23.5	20.0	11.1	11.8					K
94P2138N	72- 88	K23mb	15.0	18.1	66.9		11.1	11.5	6.6	9.4	26.8	18.7	7.6	4.4					K
94P2139S	88-104	K24mb	14.8	18.5	66.7		10.8	12.6	5.9	9.0	25.9	18.9	7.0	5.9	3	TR	--	59	3K
94P2140N	104-122	K25b	9.1	15.9	75.0		5.6	9.6	6.3	8.5	22.6	19.5	12.9	11.5					K
94P2141S	122-150	K26b	8.3	18.4	73.3		4.8	11.3	7.1	10.6	29.2	19.4	8.0	6.1	--	--	--	63	--K

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK	DENSITY	-)	COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS	-	FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT	<0.4MM	<- -	G/CC	- - ->	CM/CM	<- - -	PCT OF	<2MM	- ->	CM/CM
0- 10	0.27							1.04	0.48										2.4	
10- 16	0.21							0.67	0.38										4.6	
16- 26	0.24							0.61	0.36										5.1	
26- 36	0.26							0.54	0.37										6.4	
36- 42	0.25							0.55	0.40										6.7	
42- 51	0.41							0.59	0.46										7.2	
51- 61	0.34							0.46	0.84										8.5	
61- 72	0.27							0.37	0.84										8.7	
72- 88	0.16							0.27	0.69										10.4	
88-104	0.12							0.31	0.55										8.1	
104-122	0.14							0.60	0.66										6.0	
122-150	0.11							0.55	0.67										5.6	

AVERAGES, DEPTH 26- 42: PCT CLAY 15

Soil series: Cruces, overblown phase. Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-001 PRINT DATE 03/04/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 349, SAMPLE 94P 2130-2149

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 10	11.4	1.0	0.2	0.3	12.9	--		12.9	5.2	2	1	100	100	--				7.8	7.7	7.8
10- 16K		1.5	0.1	0.5					8.0	1	TR	100	100	2	2			8.0	7.8	8.3
16- 26K		2.0	0.1	0.4					8.5	1	1	100	100	4	4			7.8	7.8	8.1
26- 36K		2.6	0.1	0.2					9.2	1	TR	100	100	4	4	--		7.8	7.8	8.1
36- 42K		3.0	0.1	0.3					9.2	1	TR	100	100	4	4			7.9	7.8	8.2
42- 51K		3.4	0.2	0.2					9.2	3		100	100	2	63				7.9	8.3
51- 61K		2.5	1.7	0.1					4.6	37		100	100	57	74	--			7.9	8.1
61- 72K		2.9	3.6	0.1					3.8	26	14	100	100	65	71	--		7.5	8.0	8.1
72- 88K		3.5	5.7	0.1					4.0	60	16	100	100	56	56	--		8.1	8.2	8.4
88-104K		3.6	4.8	0.2					4.6	41	17	100	100	59	60	--		8.1	8.3	8.5
104-122K		3.9	2.0	0.1					5.5	21	9	100	100	61	69	--		8.0	8.0	8.5
122-150K		3.9	1.8	0.2					4.6	33	2	100	100	53	53	--		8.0	8.0	8.3

	(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 10	12.7	2.7	3.7	1.0	--	2.9	0.1	8.7				5.6	--	3.6	23.8	TR	2.09	0.45
10- 16	4.5	0.8	0.7	0.2	--	1.8	TR	1.1				2.6	--	1.0	31.4	TR	0.71	0.26
16- 26	11.9	2.4	1.5	0.2	--	1.7	0.1	2.5				11.2	--	2.0	29.4	TR	1.59	0.44
26- 36	12.5	3.5	1.1	0.1	--	1.3	0.1	4.9				8.7	--	3.5	29.8	TR	1.78	0.50
36- 42	6.6	2.2	1.0	0.1	--	1.7	0.1	2.5				5.4	--	0.9	30.9	TR	1.07	0.32
42- 51																		0.39
51- 61																		1.41
61- 72	20.1	11.9	57.7	0.3	--	1.7	0.7	74.8				18.3	--	4.0	44.7	0.3	8.05	2.53
72- 88	26.7	16.1	72.0	2.3	--	1.0	0.7	57.3				58.3	--	4.3	46.5	0.3	9.37	3.82
88-104	15.9	12.5	64.2	0.1	--	1.1	0.5	34.7				55.0	--	5.0	45.3	0.3	7.73	2.70
104-122	6.7	5.3	22.0	0.1	--	1.5	0.3	8.6				22.7	--	2.5	38.9	0.1	3.22	1.23
122-150	8.8	6.4	6.7	0.1	--	1.1	0.1	3.5				17.6	--	1.4	43.2	0.1	2.08	0.73

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 6, 7
ANALYSES: S= ALL ON SIEVED <2mm BASIS N= >2mm FRACTIONS NOT DETERMINED K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Cruces, overblown phase. Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

SSL - PROJECT 94P 63, (RP94NM124) JORNADA EXP.
- PEDON 94P 349, SAMPLES 94P 2130-2149
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
94P2142N	150-173	K27b	3.8	12.5	83.7		3.4	7.0	5.5	8.9	39.5	27.3	5.2	2.8					K
94P2143N	173-195	K28b	4.4	11.2	84.4		2.6	5.5	5.7	10.5	39.4	27.8	5.0	1.7					K
94P2144N	195-212	K29mb	4.2	9.9	85.9		2.1	4.4	5.5	11.3	33.2	24.8	9.0	7.6					K
94P2145N	212-230	K31b	3.3	13.1	83.6		1.3	6.6	6.5	10.9	32.4	23.9	9.6	6.8					K
94P2146N	230-253	K32b	3.4	16.9	79.7		2.3	12.0	4.9	8.0	31.1	26.0	9.6	5.0					K
94P2147N	253-302	K33b	3.8	18.4	77.8		1.0	13.9	4.5	9.2	26.3	28.4	10.5	3.4					K
94P2148S	302-322	C	0.1	2.8	97.1			1.7	1.1	4.7	24.8	55.7	11.7	0.2	TR	TR	--	92	TRK
94P2149S	322-352	Ck	TR	3.8	96.2			2.1	1.7	3.2	29.5	52.4	10.5	0.6	TR	TR	--	93	TRK

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM —>						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
150-173	0.07							1.42	1.32										5.0	
173-195	0.07							1.30	1.32										5.8	
195-212	0.10							1.50	1.33										5.6	
212-230	0.05							1.52	1.30										4.3	
230-253	0.06							1.65	1.53										5.2	
253-302	0.05							1.47	1.82										6.9	
302-322	TR																		2.3	
322-352	0.02																		1.8	

AVERAGES, DEPTH 26- 42: PCT CLAY 0

Soil series: Cruces, overblown phase. Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 349, SAMPLE 94P 2130-2149

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
150-173K		3.8	0.6	0.3					5.4	8	2	100	100	26	28			7.9	7.9	8.3
173-195K		3.5	0.4	0.3					5.7	6	2	100	100	23	24			8.1	7.9	8.2
195-212K		4.2	0.8	1.3					6.3	13		100	100	33	40	--			7.9	8.0
212-230K		2.7	0.8	0.3					5.0	8	2	100	100	40	44	--		7.7	7.9	8.0
230-253K		2.6	0.5	0.2					5.6	6	2	100	100	33	45	--		7.9	7.8	8.2
253-302K		2.9	0.4	0.2					5.6	5	1	100	100	33	52	--		8.0	7.8	8.2
302-322K	8.8	0.9	0.2	0.2	10.1	--		10.1	4.0	4		100	100	--	TR				8.0	8.6
322-352K		1.2	0.2	0.2					3.5	5		100	100	1	1				8.0	8.7

	(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT-	->	/cm	/cm
150-173	8.0	4.3	5.6	0.1	--	1.1	0.1	3.3				13.2	--	1.2	33.8	TR	1.75	0.43
173-195	6.9	2.6	3.4	0.1	--	1.0	0.1	2.0				9.9	--	0.9	33.0	TR	1.30	0.44
195-212																		1.14
212-230	30.3	9.6	9.8	0.2	--	0.8	0.1	6.6				38.0	--	3.3	38.5	0.1	3.67	1.12
230-253	10.0	3.5	4.5	0.1	--	0.9	0.1	1.9				15.7	--	1.2	35.0	TR	1.74	0.52
253-302	7.6	2.6	2.8	0.2	--	0.7	0.1	0.8				11.0	--	1.3	40.9	TR	1.31	0.57
302-322																		0.15
322-352																		0.17

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 15, 19, 20

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

```
                Soil series: Cruces, overblown phase. Classification: Loamy, mixed superactive, thermic, shallow Argic Petrocalcid.

                                 ***P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A***

S94NM-013-001                                                                                                    PRINT DATE 03/11/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 349, SAMPLE 94P 2130-2149

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
_____________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - - ->< - - - THERMAL - - - -><- - - - - - - - ELEMENTAL - - - - - - - ->< - -> EGME  INTER
SAMPLE       ION <                            >< - DTA - -><  - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <    > RETN  PRETA
                 < - - - - - -  7A2i - - - - - -><- 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C3 - - - - - - - - - ->    >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - -><- - - Percent - - - ->< - - - - - - - - - Percent - - - - - - - - >< - -><mg/g>< - ->

94P2130     TCLY  MI 2  KK 2  MT 1  VR 1  CA 1
94P2133     TCLY  CA 3  MI 2  KK 1  MT 1  VR 1
94P2137     TCLY  CA 3  MI 1
94P2141     TCLY  CA 5  SE 2  MT 1  MI 1
_____________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    MI  mica             KK  kaolinite        MT  montmorillon     VR  vermiculite      CA  calcite          SE  sepiolite

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
_____________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - - ->< - - - THERMAL - - - -><- - - - - - - - ELEMENTAL - - - - - - - ->< - -> EGME  INTER
SAMPLE       ION <                            >< - DTA - -><  - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <    > RETN  PRETA
                 < - - - - - -  7A2i - - - - - -><- 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C3 - - - - - - - - - ->    >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - -><- - - Percent - - - ->< - - - - - - - - - Percent - - - - - - - - >< - -><mg/g>< - ->

94P2143     TCLY  CA 3  MT 2  SE 2  MI 1
94P2145     TCLY  CA 3  MT 2  SE 1  MI 1
94P2147     TCLY  CA 2  SE 2  MT 1
94P2149     TCLY  MT 2  CA 2  MI 1
_____________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    CA  calcite          MT  montmorillon     SE  sepiolite        MI  mica

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks
```

Soil series: Bluepoint
Classification:

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-002 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

SSL - PROJECT 94P 63, (RP94NM124) JORNADA EXP.
- PEDON 94P 350, SAMPLES 94P 2150-2155
- GENERAL METHODS 1B1A, 2A1, 2B

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -		- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
94P2150S	0- 5	A	7.6	8.5	83.9		1.3	2.1	6.4	16.2	41.3	23.0	3.0	0.4	1	2	1	69	4K
94P2151S	5- 23	Bk1	6.4	6.7	86.9		1.0	1.1	5.6	14.3	41.8	27.3	3.2	0.3	TR	2	--	73	2K
94P2152S	23- 42	Bk2	5.5	6.6	87.9		1.5	1.7	4.9	12.8	43.5	27.9	3.3	0.4	1	2	--	76	3K
94P2153S	42- 65	Bk3	6.8	7.8	85.4		1.0	2.3	5.5	13.3	44.1	23.9	3.3	0.8	1	2	--	73	3K
94P2154S	65- 86	Bk4	5.4	9.9	84.7		1.5	3.4	6.5	13.5	41.8	25.4	3.4	0.6	1	2	--	72	3K
94P2155S	86-115	Bk5	6.3	11.6	82.1		1.3	3.9	7.7	12.8	38.5	26.2	3.7	0.9	1	5	1	71	7K

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK DENSITY	-)		COLE	(- - -WATER CONTENT	- -)			WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 5	0.20							0.84	0.45										3.4	
5- 23	0.19							0.88	0.53										3.4	
23- 42	0.16							1.05	0.71										3.9	
42- 65	0.14							0.71	0.50										3.4	
65- 86	0.11							1.04	0.67										3.6	
86-115	0.10							0.98	0.64										4.0	

AVERAGES, DEPTH 25-100: PCT CLAY 5 PCT .1-75MM 73

Soil series: Bluepoint. Classification: Mixed, thermic Typic Torripsamment.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 350, SAMPLE 94P 2150-2155

DEPTH (CM)	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-	EXTR	(- - - -CEC - - -)			AL	-BASE	SAT-	CO3 AS	RES.		COND.		(- - - -PH - - -)	
	CA	MG	NA	K	SUM	ITY	AL	SUM	NH4-	BASES	SAT	SUM	NH4	CACO3	OHMS		MMHOS		CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC	+ AL			OAC	<2MM	/CM		/CM		.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a	6G9c	5A3a	5A8b	5A3b	5G1	5C3	5C1	6E1g	8E1		8I		8C1f	8C1f
	<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - - -PCT - - - - ->								1:2	1:1
0- 5K		0.8	0.1	0.5					6.4			100	100	1			0.16		7.9	8.5
5- 23K		1.0	TR	0.4					5.6			100	100	1			0.15		7.9	8.5
23- 42K		1.0	0.1	0.4					5.8			100	100	2			0.14		7.9	8.4
42- 65K		1.0	TR	TR					4.8			100	100	3			0.15		7.7	8.1
65- 86K		1.2	TR	0.1					5.6			100	100	4			0.15		7.8	8.3
86-115K		1.7	0.1	0.2					6.2			100	100	6			0.24		7.8	8.2

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

SAMPLE	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	< - CLAY MINERALOGY (<.002mm) - >																			
	FRACT	< - - - - - - X-RAY - - - - - ->					< - - - THERMAL - - - ->				< - - - - - - - - ELEMENTAL - - - - - - - - ->							< - ->	EGME	INTER
SAMPLE	ION	<					>	< - DTA - ->	< - TGA - ->		SiO2	AL2O3	Fe2O3	MgO	CaO	K2O	Na2O	< >	RETN	PRETA

Soil series: Sonoita, sandy analog
Classification: Sandy, mixed, thermic Typic Haplargid
Soil survey number: S94NM-013-003
Location: SW1/4NE1/4SE1/4 sec. 4, T. 18 S., R. 1 E., 59 m west of road and 16 m southwest of pedon S94NM-013-001
Elevation: 4,365 feet, 1,330 m
Landform: North-facing side of a gentle ridge on an undulating basin floor; slope of 2 percent
Geomorphic surface: La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mostly barren; sparse fluffgrass
Described and sampled by: L.H. Gile
Date: January 2, 1994

A—0 to 5 cm; light reddish brown (6YR 6/4) sand, reddish brown (6YR 4.5/4) moist; weak thin and medium platy structure; soft, loose; few calcrete fragments, 1 to 10 mm in diameter; strongly effervescent; abrupt smooth boundary.

Bk—5 to 13 cm; yellowish red (5YR 5.5/5) fine sandy loam, yellowish red (5YR 4/5) moist; weak medium subangular blocky structure; slightly hard, very friable; very few fine and very fine roots; few carbonate filaments; slightly effervescent; clear wavy boundary.

Btk1—13 to 27 cm; yellowish red (5YR 5.5/5) fine sandy loam, yellowish red (5YR 4/5) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; very few fine and very fine roots; few carbonate filaments; sand grains coated with oriented clay; strongly effervescent; clear wavy boundary.

Btk2—27 to 41 cm; yellowish red (5YR 5.5/5) loamy sand, yellowish red (5YR 4/5) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; strongly effervescent; clear wavy boundary.

Btk3—41 to 61 cm; reddish yellow (5YR 6/5) loamy sand, yellowish red (5YR 4.5/5) moist; weak coarse subangular blocky structure; slightly hard and hard, very friable; very few fine and very fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Btk4—61 to 74 cm; yellowish red (5YR 5.5/5) loamy sand, yellowish red (5YR 4.5/5) moist; weak medium subangular blocky structure; hard and very hard, friable; very few fine and very fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Btk5—74 to 89 cm; yellowish red (5YR 5.5/5) fine sandy loam, yellowish red (5YR 4.5/5) moist; weak medium subangular blocky structure; very hard, friable; very few fine and very fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Btk6—89 to 112 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount 5YR 5/5 dry; weak medium subangular blocky structure; very hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; slightly and strongly effervescent; clear wavy boundary.

Btk7—112 to 131 cm; reddish yellow (5YR 6/5) fine sandy loam, yellowish red (5YR 4.5/5) moist, with parts slightly darker; weak medium subangular blocky structure; very hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; slightly effervescent; clear wavy boundary.

Btk8—131 to 154 cm; reddish brown (5YR 5.5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard and hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; few fine masses of K-fabric; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Btk9—154 to 170 cm; light reddish brown (5YR 6/4) loamy sand, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

Btk10—170 to 195 cm; reddish brown (5YR 5.5/4) loamy sand, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard and hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

BCtk1—195 to 210 cm; light reddish brown (5YR 6/4) loamy sand, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard and hard, friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; some parts slightly effervescent and other parts noncalcareous; clear wavy boundary.

BCtk2—210 to 233 cm; light reddish brown (5YR 6/4) loamy sand, reddish brown (5YR 4.5/4) moist;

weak medium subangular blocky structure; slightly hard, very friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; slightly effervescent; clear wavy boundary.

BCtk3—233 to 258 cm; light reddish brown (5YR 6/4) loamy sand, reddish brown (5YR 4.5/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; very few very fine roots; very few carbonate filaments; sand grains coated with oriented clay; mostly noncalcareous, but slightly effervescent in a few spots.

Soil series: Sonoita, sandy analog. Classification: Sandy, mixed, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-003 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 94P 63, (RP94NM124) JORNADA EXP.
- PEDON 94P 351, SAMPLES 94P 2156-2170
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -	-)	(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -	-SAND- -	- -	- - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT			- - - -	WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - - -	- - - -	- ->	<- PCT OF	<75MM(3B1)		->	SOIL
94P2156S	0- 5	A	4.7	7.6	87.7			2.6	5.0	10.9	41.2	29.1	5.6	0.9	1	2	--	77	3K
94P2157S	5- 13	Bk	9.7	11.3	79.0		1.5	3.7	7.6	11.9	35.7	25.9	5.1	0.4	TR	TR	--	67	TR
94P2158S	13- 27	Btk1	9.8	11.6	78.6		1.8	3.9	7.7	12.9	35.2	25.0	4.9	0.6	1	TR	--	66	1K
94P2159S	27- 41	Btk2	9.0	10.5	80.5		1.5	4.0	6.5	13.1	39.1	24.0	3.8	0.5	1	TR	--	68	1K
94P2160S	41- 61	Btk3	8.0	9.3	82.7			2.8	6.5	12.6	40.5	24.2	4.4	1.0	TR	TR	--	70	TRK
94P2161S	61- 74	Btk4	9.2	8.6	82.2			2.8	5.8	11.3	36.8	27.5	5.9	0.7	TR	TR	--	71	TRK
94P2162S	74- 89	Btk5	10.7	8.8	80.5			2.6	6.2	12.9	35.3	25.8	5.6	0.9	TR	TR	--	68	TRK
94P2163S	89-112	Btk6	12.6	9.6	77.8		1.0	3.5	6.1	12.5	35.1	24.6	4.7	0.9	1	TR	--	66	1K
94P2164S	112-131	Btk7	13.1	9.4	77.5			3.4	6.0	12.6	36.7	23.0	4.5	0.7	TR	TR	--	65	TRK
94P2165S	131-154	Btk8	11.3	9.5	79.2		1.8	3.2	6.4	12.7	35.5	25.3	5.1	0.6	TR	TR	--	66	TRK
94P2166S	154-170	Btk9	10.4	8.6	81.0		0.7	2.8	5.8	12.5	34.2	28.0	5.4	0.9	TR	TR	--	68	TRK
94P2167S	170-195	Btk10	9.2	8.8	82.0			2.6	6.2	14.0	37.0	25.6	4.9	0.5	TR	TR	--	68	TRK

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- - -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK	DENSITY -)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
0- 5	0.16							1.23	0.62										2.9	
5- 13	0.18							0.89	0.56										5.4	
13- 27	0.22							0.79	0.51										5.0	
27- 41	0.13							0.73	0.51										4.6	
41- 61	0.09							0.84	0.54										4.3	
61- 74	0.05							0.80	0.53										4.9	
74- 89	0.05							0.72	0.55										5.9	
89-112	0.08							0.69	0.49										6.2	
112-131	0.05							0.72	0.50										6.5	
131-154	0.04							0.70	0.57										6.4	
154-170	0.05							0.84	0.56										5.8	
170-195	0.06							0.96	0.58										5.3	

AVERAGES, DEPTH 25-100: PCT CLAY 9 PCT .1-75MM 69

Soil series: Sonoita, sandy analog. Classification: Sandy, mixed, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-003 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 351, SAMPLE 94P 2156-2170

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5K		0.9	TR	0.4					5.8	TR		100	100	1	3				7.8	8.4
5- 13		1.3	TR	0.4					8.6	1		100	100	1					7.8	8.4
13- 27K		1.2	TR	0.3					7.7	1		100	100	3	3				7.8	8.3
27- 41K		1.2	TR	0.2					6.6	1		100	100	2	2				7.8	8.4
41- 61K		1.6	TR	0.4					6.7	1		100	100	1	1				7.9	8.4
61- 74K		2.0	0.1	0.2					7.4	1		100	100	1	1				7.9	8.5
74- 89K		2.3	0.1	0.3					7.7	2		100	100	1	1				7.9	8.5
89-112K		2.9	0.3	0.3					8.7	3		100	100	4	4				7.9	8.6
112-131K		3.2	0.5	0.2					9.4	5		100	100	1	1				7.9	8.7
131-154K		2.9	0.6	0.1					7.9	8		100	100	4	4				7.9	8.8
154-170K		2.9	0.8	--					8.7	8	6	100	100	1	1			7.7	8.0	8.8
170-195K		3.1	0.9	TR					8.8	9	7	100	100	1	1			8.0	8.0	8.8

	(- - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.17
5- 13																		0.19
13- 27																		0.20
27- 41																		0.15
41- 61																		0.14
61- 74																		0.14
74- 89																		0.15
89-112																		0.18
112-131																		0.21
131-154																		0.23
154-170	0.9	0.2	4.1	TR	--	2.8	0.3	0.4				1.9	TR	0.1	24.4	TR	0.56	0.25
170-195	1.1	0.4	5.7	TR	--	2.3	0.4	1.6				3.0	--	0.1	23.8	TR	0.79	0.29

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Sonoita, sandy analog. Classification: Sandy, mixed, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-003 PRINT DATE 03/04/02

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -		- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - -	- - - - - -	- PCT OF <2MM	(3A1) - - -	- - - - -	- - - - -	- - -	- - -	- - -	- - ->	<- PCT OF	<75MM(3B1)		->	SOIL
94P2168S	195-210	BCtk1	7.2	8.3	84.5			2.2	6.1	12.5	39.0	27.5	4.6	0.9	TR	TR	--	72	TR
94P2169S	210-233	BCtk2	7.1	8.4	84.5			1.9	6.5	13.6	39.0	26.2	5.2	0.5	TR	TR	--	71	TRK
94P2170S	233-258	BCtk3	6.6	9.1	84.3		0.7	2.0	7.1	15.2	37.8	26.2	4.7	0.4	TR	TR	--	69	TRK

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK	DENSITY -)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
195-210	0.02							1.03	0.61										4.4	
210-233	0.04							1.01	0.54										3.8	
233-258	0.03							0.97	0.55										3.6	

AVERAGES, DEPTH 25-100: PCT CLAY 7 PCT .1-75MM 72

Soil series: Sonoita, sandy analog. Classification: Sandy, mixed, thermic Typic Haplargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-003 PRINT DATE 03/04/02

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
195-210		2.6	1.0	0.2					7.4	10	7	100	100	1				8.0	8.0	8.7
210-233K		2.6	1.1	0.1					7.2	11	7	100	100	1	1			7.8	8.0	8.5
233-258K	9.7	2.2	1.1	0.1	13.1			13.1	6.4	12	8	100	100	--	--	--		7.8	8.0	8.5

	(- - - WATER EXTRACTED FROM SATURATED PASTE- - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
195-210	2.0	0.8	8.5	TR	--	1.9	0.4	3.0				6.2	--	0.2	22.7	TR	1.18	0.35
210-233	4.5	2.0	13.0	TR	--	1.4	0.3	6.4				11.4	--	0.5	22.4	TR	1.93	0.48
233-258	4.6	2.1	14.3	0.1	--	1.3	0.1	11.5				8.4	--	0.7	22.2	TR	2.11	0.51

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

```
           -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-

          < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
          FRACT < - - - - - - X-RAY - - - - - -><- - - THERMAL - - - -><- - - - - - - - ELEMENTAL - - - - - - - -><- - -> EGME  INTER
SAMPLE     ION <                             >< - DTA - -><- - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <     > RETN  PRETA
                < - - - - - -  7A2i - - - - - -><- - 7A6b - >< - 7A4c - ><- - - - - - - - - - 7C3 - - - - - - - - - -><     >  7D2   TION
NUMBER    <- - >< - - - - peak size - - - - -><- - - - Percent - - - -><- - - - - - - - - Percent - - - - - - - -><- -><mg/g>< - ->

94P2156     TCLY  CA 3  MT 2  MI 2  KK 2  QZ 1
94P2158     TCLY  CA 3  MT 2  MI 2  KK 2  QZ 1
94P2161     TCLY  MT 2  MI 2  KK 2  CA 1  QZ 1
94P2161     TCLY  HE 1
```

FRACTION INTERPRETATION:

TCLY Total Clay, <0.002mm

MINERAL INTERPRETATION:

CA calcite MT montmorillon MI mica KK kaolinite QZ quartz HE hematite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

Soil series: Yucca, deep argillic analog
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S94NM-013-004
Location: SW1/4NE1/4SE1/4 sec. 4, T. 18 S., R. 1 E., 69 m west of road and 11 m southeast of pedon S94NM-013-001
Elevation: 4,365 feet, 1,330 m
Landform: North-facing side of a gentle ridge on an undulating basin floor; slope of 2 percent
Geomorphic surface: La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mostly barren; sparse snakeweed and fluffgrass
Described and sampled by: L.H. Gile
Date: January 6, 1994

A—0 to 4 cm; reddish brown (5YR 5.5/4) loamy sand, reddish brown (5YR 4/4) moist; weak medium platy structure and single grain; soft and loose; few calcrete fragments, mostly 2 mm to 2 cm in diameter; strongly effervescent; abrupt smooth boundary.
BA—4 to 10 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; very few very fine roots; very few fine calcrete fragments; strongly effervescent; clear wavy boundary.
Bk1—10 to 23 cm; light reddish brown (5YR 6/4) loamy sand, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few very fine roots; very few fine calcrete fragments; few carbonate filaments; strongly effervescent; clear wavy boundary.
Bk2—23 to 40 cm; light reddish brown (6YR 6/4) fine sandy loam, reddish brown (6YR 4.5/4) moist; weak medium subangular blocky structure; slightly hard and hard, very friable; very few very fine roots; few fine calcrete fragments; few carbonate filaments and nodules; strongly effervescent; clear wavy boundary.
Bk3—40 to 54 cm; light brown (7.5YR 6.5/4) fine sandy loam, brown to dark brown (7.5YR 4.5/4) moist; weak medium subangular blocky structure; hard, very friable; very few very fine roots; few fine calcrete fragments; few carbonate filaments and fine nodules; strongly effervescent; clear wavy boundary.
K1—54 to 66 cm; pinkish gray to pink (7.5YR 7/3) fine sandy loam, brown (7.5YR 5.5/3) moist; a lesser amount 7.5YR 6/3 and 7/4 dry; weak medium and coarse subangular blocky structure; very hard, friable; very few very fine roots; common carbonate nodules; few fine calcrete fragments; strongly effervescent; clear wavy boundary.
K2—66 to 81 cm; pink and pinkish gray to pink (7.5YR 7/4, 7/3) fine sandy loam, brown (7.5YR 5/4, 5/3) moist; weak medium and coarse subangular blocky structure; very hard, friable; very few very fine roots; common carbonate nodules; few fine calcrete fragments; few carbonate filaments; strongly effervescent; clear wavy boundary.
K3—81 to 96 cm; pink (6YR 7/4) fine sandy loam, reddish brown (6YR 5.5/4) moist; weak medium and coarse subangular blocky structure; very hard, friable; very few very fine roots; common carbonate nodules; few fine calcrete fragments; few carbonate filaments; strongly effervescent; clear wavy boundary.
Btk1—96 to 115 cm; reddish brown (5YR 5.5/4) fine sandy loam, reddish brown (5YR 4/4) moist; a lesser amount of 7.5YR 8/2 (dry) as coatings on peds and as few fine nodules; weak medium and coarse subangular blocky structure; very hard, friable; very few very fine roots; sand grains in reddish brown parts coated with oriented clay; common carbonate coatings on peds; few fine carbonate nodules; few carbonate filaments; strongly effervescent; clear wavy boundary.
Btk2—115 to 145 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount of 7.5YR 8/2 (dry) as coatings on peds and as few fine nodules; weak medium and coarse subangular blocky structure; very hard, friable; very few very fine roots; sand grains in reddish brown parts coated with oriented clay; common carbonate coatings on peds; few fine carbonate nodules; common carbonate filaments; strongly effervescent.

Soil series: Yucca, deep argillic analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-004 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 94P 63, (RP94NM124) JORNADA EXP.
- PEDON 94P 352, SAMPLES 94P 2171-2180
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -)		(-COARSE	FRACTIONS(MM)-)			(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - - -	- - - -	->	<- PCT	OF	<75MM(3B1)	->	SOIL
94P2171S	0- 4	A	7.7	11.4	80.9		1.5	3.3	8.1	13.8	37.9	25.4	3.5	0.3	TR	2	1	68	3K
94P2172S	4- 10	BA	9.9	13.8	76.3		3.2	3.9	9.9	11.5	34.8	24.1	5.2	0.7	TR	TR	--	65	TRK
94P2173S	10- 23	Bk1	8.5	11.3	80.2		2.3	3.5	7.8	11.6	36.1	26.3	5.4	0.8	1	1	--	69	2K
94P2174S	23- 40	Bk2	9.7	14.7	75.6		2.9	4.7	10.0	13.0	33.8	23.6	4.4	0.8	1	2	--	64	3K
94P2175S	40- 54	Bk3	9.7	15.7	74.6		2.9	5.5	10.2	12.3	35.0	22.5	4.0	0.8	1	2	--	63	3K
94P2176S	54- 66	K1	12.1	17.0	70.9		5.0	6.8	10.2	10.9	35.5	20.2	3.5	0.8	1	2	--	61	3K
94P2177S	66- 81	K2	14.0	14.6	71.4		8.0	5.3	9.3	11.1	36.5	19.4	3.2	1.2	2	3	--	62	5K
94P2178S	81- 96	K3	15.3	11.6	73.1		7.5	3.7	7.9	11.6	35.4	21.6	4.0	0.5	2	1	--	63	3K
94P2179S	96-115	Btk1	19.5	9.1	71.4		6.2	2.4	6.7	13.6	34.1	20.3	2.9	0.5	1	1	--	59	2K
94P2180S	115-145	Btk2	16.8	8.7	74.5		5.3	2.1	6.6	11.6	35.6	22.5	3.7	1.1	1	1	--	64	2K

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK	DENSITY -)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3	6R3b	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF	<2MM	- ->		CM/CM
0- 4	0.15							0.91	0.48										3.7	
4- 10	0.14							0.69	0.46										4.6	
10- 23	0.18							0.79	0.53										4.5	
23- 40	0.13							0.69	0.46										4.5	
40- 54	0.13							0.72	0.38										3.7	
54- 66	0.13							0.50	0.43										5.2	
66- 81	0.13							0.39	0.38										5.3	
81- 96	0.12							0.39	0.39										6.0	
96-115	0.08							0.49	0.43										8.4	
115-145	0.06							0.57	0.37										6.2	

AVERAGES, DEPTH 25-100: PCT CLAY 7 PCT .1-75MM 62

Soil series: Yucca, deep argillic analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S94NM-013-004 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 352, SAMPLE 94P 2171-2180

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 4K		1.0	--	0.3					7.0	TR		100	100	3	4				7.9	8.5
4- 10K		1.1	--	TR					6.8	TR		100	100	6	6				7.8	8.4
10- 23K		0.9	--	0.3					6.7	TR		100	100	4	5				7.8	8.4
23- 40K		1.0	--	0.1					6.7	TR		100	100	7	7				7.8	8.4
40- 54K		1.4	--	0.2					7.0	TR		100	100	7	9				7.8	8.4
54- 66K		1.4	0.1	--					6.1	1		100	100	11	12				7.7	8.2
66- 81K		1.5	0.1	--					5.5	1	1	100	100	14	16			7.8	7.8	8.4
81- 96K		1.7	0.1	--					6.0	1	1	100	100	12	13			7.9	7.8	8.4
96-115K		2.6	0.2	TR					9.5	1	1	100	100	10	10			7.8	7.8	8.3
115-145K		2.7	0.3	--					9.6	2	2	100	100	9	10			7.8	7.8	8.3

	(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1a	6K1c	6S9a	6X1a	6Y1a	6L1c	6W1a	6M1c	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT-	->	/cm	/cm
0- 4																		0.16
4- 10																		0.17
10- 23																		0.16
23- 40																		0.17
40- 54																		0.17
54- 66																		0.19
66- 81	3.1	0.6	0.7	0.1	--	1.7	0.1	0.6				2.1	TR	0.4	26.2	TR	0.54	0.25
81- 96	3.1	0.7	1.3	TR	--	1.5	0.1	0.4				3.1	TR	0.3	28.7	TR	0.58	0.27
96-115	3.8	0.9	1.5	0.1	--	1.5	0.1	0.6				3.9	0.1	0.3	32.2	TR	0.67	0.30
115-145	4.3	1.1	2.5	0.1	--	1.5	0.1	1.5				4.3	TR	0.8	32.5	TR	0.85	0.31

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

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     Soil series: Yucca, deep argillic analog.  Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

                               ***P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A***

S94NM-013-004                                                                                                  PRINT DATE 03/11/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 94P 352, SAMPLE 94P 2171-2180

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
___________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - ->< - - - THERMAL - - - -->< - - - - - - - ELEMENTAL - - - - - - - - ->< - -> EGME  INTER
SAMPLE       ION <                            >< - DTA - -->< - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO    K2O    Na2O <     > RETN  PRETA
                 < - - - - - -  7A2i - - - - - -->< - 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C3 - - - - - - - - - -><     >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - -->< - - - Percent - - - -->< - - - - - - - - - Percent - - - - - - - - -->< - -><mg/g>< - ->

94P2171     TCLY  CA 3  MT 2  KK 2  MI 2  QZ 1
94P2175     TCLY  CA 3  MT 2  KK 2  MI 1  QZ 1
94P2179     TCLY  CA 3  MT 2  KK 1  MI 1  QZ 1
___________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    CA  calcite          MT  montmorillon     KK  kaolinite        MI  mica             QZ  quartz

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks
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Soil series: SND #3 (series not designated)
Classification: Fine-loamy, mixed, superactive, thermic Arenic Paleargid
Soil survey number: S95NM-013-001
Location: NW$^1/_4$SE$^1/_4$SE$^1/_4$ sec. 32, T. 19 S., R. 1 E., 35 m north of road
Elevation: 4,345 feet, 1,324 m
Landform: Side of a gentle ridge on an undulating basin floor; slope of 3 percent, facing east
Geomorphic surface: Organ (eolian analog)
Parent material: Sandy eolian material in the upper 96 cm; below 96 cm, upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mesquite, dropseed, Mormon tea, soaptree yucca

white (10YR 8.2) moist; a lesser amount slightly darker or lighter; weak medium and coarse subangular blocky structure; hard and very hard, very firm; strongly effervescent.

Soil series: SND #3. Classification: Fine-loamy, mixed, superactive, thermic Arenic Paleargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 453, SAMPLES 95P 3315-3328
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -	-)	(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -	-SAND- -	- - -	- -)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	- PCT OF <2MM		(3A1) - - -	- - - -	- - - -	- - - -	- - -	- ->	<- PCT OF	<75MM(3B1)		->	SOIL
95P3315S	0- 10	A	5.3	3.2	91.5			0.4	2.8	10.8	47.1	30.4	3.0	0.2	--	TR	--	81	--
95P3316S	10- 27	B1	6.2	4.9	88.9			TR	4.9	12.7	46.8	26.3	2.8	0.3	--	--	--	76	--
95P3317S	27- 43	B2	6.8	5.2	88.0			0.6	4.6	14.3	48.8	22.9	2.0	TR	--	--	--	74	--
95P3318S	43- 62	B3	6.5	3.8	89.7			0.1	3.7	9.9	44.4	32.4	2.9	0.1	TR	TR	--	80	TR
95P3319S	62- 82	B4	6.5	4.8	88.7			0.3	4.5	11.2	46.9	27.4	3.0	0.2	--	TR	--	77	TR
95P3320S	82- 96	B5	6.0	3.7	90.3			TR	3.7	6.7	39.6	37.7	6.1	0.2	--	TR	--	84	--
95P3321S	96-115	Bt1b	17.6	2.9	79.5			0.6	2.3	5.6	33.5	33.3	6.6	0.5	--	--	--	74	--
95P3322S	115-137	Bt2b	25.1	3.0	71.9			0.4	2.6	6.9	37.3	24.7	2.8	0.2	TR	--	--	65	--
95P3323S	137-160	Btk1b	19.2	3.8	77.0			0.6	3.2	7.3	37.0	28.4	3.8	0.5	TR	TR	--	70	--
95P3324S	160-186	Btk2b	18.2	2.9	78.9			0.2	2.7	6.8	35.8	30.1	5.6	0.6	TR	--	--	72	--
95P3325S	186-206	Btk3b	19.0	3.1	77.9			0.2	2.9	7.6	37.3	28.2	4.4	0.4	TR	TR	--	70	TR
95P3326S	206-225	Btk4b	28.9	2.5	68.6			0.9	1.6	7.4	34.2	24.2	2.7	0.1	TR	TR	--	61	TR

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM	->			PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
0- 10	0.14	0.031						0.74	0.28										1.5	
10- 27	0.13							0.77	0.39										2.4	
27- 43	0.10	0.030						0.74	0.40										2.7	
43- 62	0.07							0.74	0.42										2.7	
62- 82	0.11							0.69	0.37										2.4	
82- 96	0.08							0.75	0.40										2.4	
96-115	0.11							0.64	0.40										7.1	
115-137	0.09							0.64	0.40										10.0	
137-160	0.02							0.67	0.47										9.0	
160-186	0.04							0.76	0.47										8.5	
186-206	--							0.69	0.45										8.5	
206-225	0.05							0.74	0.47										13.7	

AVERAGES, DEPTH 96-146: PCT CLAY 21 PCT .1-75MM 69

Soil series: SND #3. Classification: Fine-loamy, mixed, superactive, thermic Arenic Paleargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 453, SAMPLE 95P 3315-3328

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 10	2.4	0.8	TR	0.3	3.5	1.3		4.8	3.9	1		73	90						6.3	7.1
10- 27	3.6	0.8	--	0.3	4.7	0.9		5.6	4.8	TR		84	98						6.7	7.3
27- 43	3.7	0.9	--	0.2	4.8	1.5		6.3	5.0	TR		76	96						6.8	7.5
43- 62	3.4	1.0	--	0.2	4.6	1.1		5.7	4.8	TR		81	96						6.8	7.5
62- 82	3.2	0.9	--	0.2	4.3	0.8		5.1	4.5	TR		84	96						6.8	7.6
82- 96	3.1	0.9	TR	0.2	4.2	0.7		4.9	4.5	1		86	93						6.8	7.6
96-115	8.0	2.3	0.5	0.4	11.2			11.2	11.2	5		100	100						6.8	7.9
115-137	12.1	3.3	0.9	0.5	16.8			16.8	16.0	6		100	100						7.6	8.4
137-160		2.7	1.1	0.4					12.9	7	5	100	100	1				7.8	7.8	8.3
160-186		2.9	1.5	0.4					13.8	9	5	100	100	1		--		7.5	7.7	8.1
186-206	11.8	2.7	1.5	0.4	16.4			16.4	13.2	8	6	100	100	TR		--		7.5	7.7	8.1
206-225	20.4	4.6	2.7	0.6	28.3			28.3	21.4	8	6	100	100	TR		--		7.5	7.6	7.8

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 10																		0.04
10- 27																		0.06
27- 43																		0.07
43- 62																		0.08
62- 82																		0.05
82- 96																		0.06
96-115																		0.08
115-137																		0.21
137-160	2.7	0.8	6.1	0.2	--	1.3	0.1	2.5				5.5	--	0.3	34.5	TR	1.13	0.37
160-186	6.0	1.6	8.8	0.2	--	1.2	0.4	5.3				9.8	--	0.5	34.0	TR	1.73	0.63
186-206	9.0	2.6	13.9	0.1	--	1.4	0.6	8.1				15.6	--	--	35.8	0.1	2.46	0.70
206-225	20.1	5.4	20.1	0.2	--	1.2	1.1	14.7				28.1	--	--	46.8	0.1	3.88	1.33

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: SND #3. Classification: Fine-loamy, mixed, superactive, thermic Arenic Paleargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-001 PRINT DATE 03/04/02

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 453, SAMPLES 95P 3315-3328
- GENERAL METHODS 1B1A, 2A1, 2B

			-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT			- - - -	WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
95P3327S	225-232	K1b	18.8	14.4	66.8		5.1	10.4	4.0	9.3	31.7	18.6	4.8	2.4	1	2	--	59	3K
95P3328S	232-242	K21b	10.2	19.2	70.6		5.9	13.4	5.8	10.1	26.6	14.7	8.8	10.4	2	7	--	64	9K

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM -->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
225-232	0.10							0.54	0.48										9.1	
232-242	0.11							0.45	0.65										6.6	

AVERAGES, DEPTH 96-146: PCT CLAY 14 PCT .1-75MM 59

Soil series: SND #3. Classification: Fine-loamy, mixed, superactive, thermic Arenic Paleargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 453, SAMPLE 95P 3315-3328

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
225-232K		2.7	1.6	0.3					10.2	9	4	100	100	25	26	1		7.6	7.8	7.8
232-242K		1.6	0.9	0.1					4.6	10	3	100	100	47	49	--		7.7	7.9	8.1

	(- - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT-	->	/cm	/cm
225-232	27.2	5.9	18.0	0.2	--	1.2	0.8	10.9				35.5	--	--	38.3	0.1	3.97	2.37
232-242	23.4	4.2	10.4	0.1	--	1.0	0.7	5.8				29.5	--	--	37.9	0.1	3.01	1.28

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Yucca, deep analog
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S95NM-013-002
Location: SE1/4NE1/4SW1/4 sec. 9, T. 20 S., R. 2 E., 60 m west of Jornada Road
Elevation: 4,330 feet, 1,320 m
Landform: Crest of ridge
Geomorphic surface: Jornada-La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Lehmann lovegrass, black grama, dropseed, mesquite
Described and sampled by: L.H. Gile
Date: Horizons from 0 to 222 cm—February 27, 1995; horizons from 222 to 460 cm—November 8, 1998

1995 Sampling

C1—0 to 6 cm; reddish brown (5YR 5/4) sand, reddish brown (5YR 4/4) moist; massive, single grain, and weak thick platy structure; soft, loose, very friable; few fine and very fine roots; some parts noncalcareous and other parts weakly effervescent; clear wavy boundary.

C2—6 to 19 cm; reddish brown (5YR 5/4) sand, reddish brown (5YR 4/4) moist; massive, single grain in places with horizontal cleavage to thin lenses; soft, loose, very friable; few fine and very fine roots; noncalcareous; abrupt smooth boundary.

BAtb—19 to 29 cm; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3.5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; very few fine and very fine roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Bt1b—29 to 43 cm; reddish brown (4YR 4.5/4) fine sandy loam, dark reddish brown (4YR 3.5/4) moist; weak medium and coarse subangular blocky structure; hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; noncalcareous; clear wavy boundary.

Bt2b—43 to 61 cm; reddish brown (4YR 4.5/4) fine sandy loam, dark reddish brown (4YR 3.5/4) moist; weak medium subangular blocky structure; very hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; noncalcareous; clear wavy boundary.

Btk1b—61 to 70 cm; reddish brown (4YR 4.5/4) fine sandy loam, dark reddish brown (4YR 3.5/4) moist; weak medium subangular blocky structure; very hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; few carbonate filaments; some parts noncalcareous and other parts weakly or strongly effervescent; clear wavy boundary.

Btk2b—70 to 83 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; very hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; few carbonate filaments; strongly effervescent; clear wavy boundary.

Btk3b—83 to 101 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; weak medium subangular blocky structure; very hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; few carbonate filaments; strongly effervescent; clear wavy boundary.

Btk4b—101 to 118 cm; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4.5/4) moist; a lesser amount slightly redder; weak medium subangular blocky structure; very hard and extremely hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; few carbonate filaments; some parts noncalcareous and other parts weakly or strongly effervescent; clear wavy boundary.

Btk5b—118 to 138 cm; reddish yellow (5YR 6/5) fine sandy loam, yellowish red (5YR 5/5) moist; a lesser amount slightly redder; weak medium subangular blocky structure; extremely hard, friable; very few fine and very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; few carbonate filaments; some parts noncalcareous and other parts weakly or strongly effervescent; clear wavy boundary.

K1b—138 to 155 cm; pink (7.5YR 9/4) sandy loam, pink (7.5YR 8/4) moist; a lesser amount 7.5YR 7/4; weak medium subangular blocky structure; extremely hard, friable; very few very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K21b—155 to 177 cm; pinkish white (7.5YR 9/2) sandy loam, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount 7.5YR 7/4; weak medium subangular blocky structure; extremely hard, friable; very few very fine roots; sand grains coated with oriented clay; few insect burrows, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K22b—177 to 203 cm; pinkish white (7.5YR 8/2) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount slightly darker or lighter; weak medium subangular blocky structure; extremely hard, friable; very few very fine roots; strongly effervescent; clear wavy boundary.

K/Btb2—203 to 222 cm; pink (5YR 7/3) fine sandy loam, reddish brown (5YR 5.5/4) moist; a lesser amount slightly darker or lighter; weak medium subangular blocky structure; extremely hard, friable; very few very fine roots; strongly effervescent.

1998 Sampling

K1b2—222 to 239 cm; pinkish white (7.5YR 8/2) sandy clay loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium subangular blocky structure; hard and very hard, friable; common carbonate nodules; few parts slightly darker and redder; strongly effervescent; clear wavy boundary.

K21b2—239 to 256 cm; pinkish white (7.5YR 9/2) sandy clay loam, pinkish gray to pink (7.5YR 7/3) moist; weak coarse subangular blocky structure; extremely hard, friable; few parts slightly darker and redder; common carbonate nodules; strongly effervescent; clear wavy boundary.

K22b2—256 to 292 cm; pinkish white (7.5YR 9/2) sandy clay loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium and coarse subangular blocky structure; very hard and extremely hard, friable; common carbonate nodules; strongly effervescent; clear wavy boundary.

K31b2—292 to 317 cm; pinkish white (7.5YR 8/2) sandy clay loam, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; very hard and extremely hard, friable; common carbonate nodules and irregular masses, 1 to 5 cm in diameter; strongly effervescent; clear wavy boundary.

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-002 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 454, SAMPLES 95P 3329-3342
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON		LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
95P3329S	0- 6	C1		6.5	5.2	88.3			1.0	4.2	9.4	39.1	36.2	3.5	0.1	--	--	--	79	--
95P3330S	6- 19	C2		6.4	4.6	89.0			0.3	4.3	10.3	41.4	34.5	2.7	0.1	--	--	--	79	--
95P3331S	19- 29	BAtb		11.9	7.3	80.8			1.8	5.5	11.5	38.1	27.4	3.7	0.1	--	--	--	69	--
95P3332S	29- 43	Bt1b		13.6	5.9	80.5			2.1	3.8	8.0	33.1	33.1	6.0	0.3	TR	--	--	72	--
95P3333S	43- 61	Bt2b		14.1	7.2	78.7			2.2	5.0	8.0	30.6	33.1	6.4	0.6	TR	--	--	71	TR
95P3334S	61- 70	Btk1b		14.9	7.6	77.5			2.2	5.4	8.4	31.7	30.6	6.1	0.7	TR	1	--	69	1
95P3335S	70- 83	Btk2b		18.4	8.6	73.0		2.1	2.9	5.7	8.5	28.0	29.0	6.6	0.9	1	1	--	65	2
95P3336S	83-101	Btk3b		19.3	7.0	73.7		1.8	2.1	4.9	8.5	30.9	28.5	5.1	0.7	TR	TR	--	65	TR
95P3337S	101-118	Btk4b		16.9	5.9	77.2		0.7	2.3	3.6	8.0	31.1	32.4	5.2	0.5	TR	TR	--	69	TR
95P3338S	118-138	Btk5b		15.8	5.1	79.1			1.1	4.0	8.8	33.7	30.4	5.2	1.0	TR	TR	--	70	TR
95P3339S	138-155	K1b		15.9	11.1	73.0		6.1	6.5	4.6	7.1	29.8	28.9	6.6	0.6	TR	TR	--	66	TR
95P3340S	155-177	K21b		17.2	13.1	69.7		10.2	9.2	3.9	6.4	27.5	28.4	6.6	0.8	TR	TR	--	63	--

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM -->				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 6	0.29							0.94	0.45										2.9	
6- 19	0.14							0.84	0.33										2.1	
19- 29	0.25							0.72	0.33										3.9	
29- 43	0.22							0.82	0.38										5.2	
43- 61	0.21							0.67	0.38										5.3	
61- 70	0.17							0.66	0.36										5.3	
70- 83	0.22							0.57	0.40										7.4	
83-101	0.19							0.58	0.38										7.4	
101-118	0.10							0.72	0.40										6.7	
118-138	0.05							0.70	0.42										6.7	
138-155	0.09							0.50	0.39										6.2	
155-177	0.08							0.40	0.35										6.1	

AVERAGES, DEPTH 19- 69: PCT CLAY 14 PCT .1-75MM 71

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S95NM-013-002 PRINT DATE 03/04/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 454, SAMPLE 95P 3329-3342

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 6		1.1	0.2	0.6					6.1	3		100	100	1					7.7	8.3
6- 19	7.9	0.8	0.1	0.5	9.3			9.3	5.4	2		100	100	TR					7.9	8.5
19- 29	8.2	1.2	0.1	0.8	10.3			10.3	8.6	1		100	100	TR					7.8	8.4
29- 43	9.1	1.6	0.1	0.6	11.4			11.4	11.2	1		100	100						7.7	8.4
43- 61	9.5	2.0	0.1	0.4	12.0			12.0	9.5	1		100	100						7.7	8.3
61- 70		2.4	0.1	0.4					9.8	1		100	100	1					7.8	8.3
70- 83		3.5	0.2	0.4					10.5	2		100	100	3					7.9	8.4
83-101		4.0	0.4	0.4					11.1	4		100	100	2					7.9	8.5
101-118		4.8	0.7	0.4					12.1	6		100	100	2					8.0	8.7
118-138		4.9	1.2	0.3					11.1	8	5	100	100	2		--		7.9	7.9	8.4
138-155		4.7	1.9	0.2					7.9	10	7	100	100	16		--		7.8	8.0	8.2
155-177		4.5	2.1	0.2					6.8	12	8	100	100	22		--		7.9	8.1	8.2

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 6																		0.16
6- 19																		0.12
19- 29																		0.14
29- 43																		0.13
43- 61																		0.16
61- 70																		0.17
70- 83																		0.17
83-101																		0.20
101-118																		0.21
118-138	5.3	3.5	11.3	0.2	--	1.6	0.6	15.7				4.7	--	--	29.8	TR	2.15	0.54
138-155	19.9	16.7	32.0	0.2	--	0.7	TR	51.9				20.4	--	3.6	36.8	0.2	6.11	1.54
155-177	20.9	18.4	34.9	0.2	--	0.8	1.6	56.4				22.0	--	--	37.4	0.2	6.44	1.60

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6, 7, 8, 9
ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-002 PRINT DATE 03/04/02

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 454, SAMPLES 95P 3329-3342
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
95P3341S	177-203	K22b	15.5	13.3	71.2		9.1	9.5	3.8	6.7	30.2	30.3	3.6	0.4	TR	--	--	64	--
95P3342S	203-222	K/Btb2	12.3	9.8	77.9		4.8	5.7	4.1	6.5	31.9	32.6	6.2	0.7	1	3	2	73	6K

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c	(- - DITH-CIT - -) EXTRACTABLE FE 6C2b	AL 6G7a	MN 6D2a	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A5	1/3 BAR 4A1d	OVEN DRY 4A1h	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1c	1/3 BAR 4B1c	15 BAR 4B2a	WRD WHOLE SOIL 4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM	->			PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
177-203	0.04							0.42	0.39										6.0	
203-222	0.04							0.55	0.40										4.9	

AVERAGES, DEPTH 19- 69: PCT CLAY 6 PCT .1-75MM 65

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S95NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 454, SAMPLE 95P 3329-3342

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
177-203		4.2	1.8	0.1					6.5	12	8	100	100	20		--		8.0	8.0	8.2
203-222K		4.0	1.5	0.2					6.8	11	7	100	100	11	11	--		8.1	8.0	8.3

	(- - - - WATER EXTRACTED FROM SATURATED PASTE- - - -)																PRED.
															TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - MEQ / LITER - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
177-203	11.7	10.9	25.7	0.1	--	0.8	1.1	30.2				15.5	--	3.2	38.9	0.1	4.64	1.30
203-222	8.5	7.4	21.1	0.1	--	1.1	1.1	17.9				17.8	--	--	35.0	0.1	3.48	0.92

ANALYSES: S= ALL ON SIEVED <2mm BASIS K= CACO3 ON 20-2 AND <2mm FRACTION

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-002A PRINT DATE 03/04/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 226, SAMPLES 99P 1182-1190
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
99P1182N	222-239	K1b2	21.0	16.0	63.0		8.1	13.3	2.7	7.6	30.5	20.2	3.6	1.1					
99P1183N	239-256	K21b2	22.8	19.0	58.2		10.3	15.0	4.0	8.3	26.4	18.0	4.6	0.9					
99P1184N	256-292	K22b2	24.3	17.6	58.1		12.5	14.1	3.5	7.5	24.5	19.2	5.4	1.5					
99P1185N	292-317	K31b2	20.6	12.0	67.4		7.0	8.9	3.2	7.9	29.1	23.0	6.1	1.3					
99P1186N	317-345	K32b2	18.2	10.8	71.0		6.5	8.0	2.8	7.3	32.6	24.6	5.5	1.0					
99P1187N	345-375	K/Btb3	3.9	10.1	86.0		1.5	5.6	4.5	9.2	34.5	29.0	9.3	4.0					
99P1188S	375-396	Ck1b3	6.9	6.9	86.2		1.5	4.1	2.8	7.5	35.0	33.9	7.8	2.0	3	11	2	82	16
99P1189S	396-432	Ck2b3	3.5	6.0	90.5		0.7	2.8	3.2	5.4	30.8	39.9	11.9	2.5	4	7	--	87	11
99P1190S	432-460	Ck3b3	1.6	1.2	97.2			0.9	0.3	2.2	29.0	47.4	14.1	4.5	5	4	--	95	9

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2h	6G7g	6D2g	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
222-239								0.34	0.39										8.1	
239-256									0.35										7.9	
256-292									0.33										8.0	
292-317								0.24	0.38										7.9	
317-345								0.41	0.40										7.2	
345-375								2.54	1.49										5.8	
375-396								0.90	0.58										4.0	
396-432								1.66	0.94										3.3	
432-460								2.56	1.25										2.0	

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-002A PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 226, SAMPLE 99P 1182-1190

DEPTH (CM)	-1- NH4OAC EXTRACTABLE BASES CA 5B5a 6N2i	-2- MG 5B5a 6O2h	-3- NA 5B5a 6P2f	-4- K 5B5a 6Q2f	-5- SUM BASES	-6- ACIDITY 6H5a	-7-	-8- CEC SUM CATS 5A3a	-9- CEC NH4-OAC 5A8b	-10- EXCH NA 5D2	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1h	-15- CARBONATE AS CACO3 <20MM 6E4b	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f 1:2	-20- PH H2O 8C1f 1:1
	<- - - -	- - - -	- - -	-MEQ / 100 G	- - - -	- - - -	- - -	- - -	- ->	PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->				
222-239		6.2	2.7	TR					7.2	16	8	100	100	25		--		8.0	8.1	8.2
239-256											8			32		--		8.0	8.1	8.2
256-292											6			32		TR		7.9	8.0	8.1
292-317		4.1	1.7	--					4.9	1	7	100	100	16		--		7.9	8.0	8.1
317-345		6.7	2.7	0.1					7.5	16	8	100	100	15		TR		7.8	8.0	8.8
345-375		6.6	2.9	0.1					9.9	16	9	100	100	18		--		7.9	8.0	8.3
375-396		4.9	2.1	0.1					6.2	21	9	100	100	6		--		8.0	8.1	8.4
396-432		4.2	1.8	TR					5.8	18	10	100	100	5		--		8.1	8.1	8.6
432-460	8.0	2.0	1.2	--	11.2	--		11.2	4.1	22	11	100	100	TR				8.4	8.2	8.8

DEPTH (CM)	WATER EXTRACTED FROM SATURATED PASTE CA 6N1d	MG 6O1d	NA 6P1d	K 6Q1d	CO3 6I1b	HCO3 6J1b	F 6U1c	CL 6K1e	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1e	NO2 6W1c	NO3 6M1e	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - -	- - -	- - -	- - -	- - -	- - -	MEQ / LITER	- - -	- - -	- - -	- - -	- - -	- - -	- ->	<- -PCT-	->	/cm	/cm
222-239	12.3	19.1	33.6	0.2	--	0.8	0.6	43.2				20.2	--	0.8	46.4	0.2	6.15	1.91
239-256	12.6	18.5	32.4	0.2	--	0.9	0.6	38.4				21.0	--	1.0	46.3	0.2	6.09	2.05
256-292	28.9	25.6	33.2	0.3	--	0.8	0.5	30.0				51.8	--	1.1	46.1	0.3	7.04	3.94
292-317	28.7	28.8	38.7	0.2	--	0.8	0.5	32.8				58.2	--	0.8	43.6	0.3	7.62	3.52
317-345	24.6	26.0	39.6	0.2	--	0.8	--	29.2				56.8	--	0.8	35.9	0.2	7.29	3.78
345-375	17.1	18.6	39.6	0.1	--	1.1	--	22.8				48.9	--	0.9	33.1	0.2	6.47	1.57
375-396	8.4	10.9	29.3	0.1	--	1.1	--	19.7				25.5	--	0.6	28.4	0.1	4.55	1.05
396-432	5.4	7.2	24.8	0.1	--	1.2	--	15.7				20.9	--	0.5	28.0	0.1	3.69	0.81
432-460	1.4	1.9	13.7	0.1	--	1.9	0.1	9.5				5.1	--	0.3	25.5	TR	1.85	0.44

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-002A PRINT DATE 03/13/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 226, SAMPLES 99P 1182-1190
- GENERAL METHODS 1B1A, 2A1, 2B

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
		ACID OXALATE EXTRACTION				PHOSPHOUS		KCL	TOTAL	(- -WATER CONTENT- -)				(- - - - WATER DISPERSIBLE - - - -)						MIN	AGGRT
		OPT	FE	SI	AL		CIT-	MN	C	0.06	1-	2-	15	<- - PIPETTE - - >			< - HYDROMETER - >			SOIL	STABL
		DEN				RET	ACID			BAR	BAR	BAR	BAR	CLAY	SILT	SAND	CLAY	SILT	SAND	CONT	<5mm
SAMPLE	HZ	8J1c	6C9b	6V2b	6G12b	6S4d	6S5	6D3b	6A2e	4B1c	4B1a	4B1a	4B2b	<- - -	3A1c	- - ->	<- - -	SML	- - ->	8F1	4G1
NO.	NO		<- P C T o f < 2 m m ->			<- P P M ->			< - - - - - - - - - - - P E R C E N T o f < 2 m m - - - - - - - - >										<20mm>	< PCT>
99P1182	1								2.90												
99P1183	2								3.99												
99P1184	3								2.79												
99P1185	4								1.79												
99P1186	5								1.45												
99P1187	6								2.06												
99P1188	7								0.63												
99P1189	8								0.46												
99P1190	9								0.03												

Soil series: Yucca, calcareous analog
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S95NM-013-003
Location: NW1/4SE1/4SW1/4 sec. 9, T. 20 S., R. 2 E., 45 m south of road
Elevation: 4,320 feet, 1,317 m
Landform: Side of a gentle ridge; slope of 1 percent, facing west
Geomorphic surface: Jornada-La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mesquite, dropseed, snakeweed, soaptree yucca
Described and sampled by: L.H. Gile
Date: Horizons from 0 to 141 cm—February 27, 1995; horizons from 141 to 335 cm—January 23, 1997; horizons from 335 to 446 cm—November 4, 1998

1995 Sampling

A—0 to 5 cm; reddish brown (5YR 5.5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak medium and thick platy structure; soft, loose, very friable; few very fine roots; strongly effervescent; abrupt smooth boundary.

Btk1—5 to 18 cm; reddish brown (5YR 5.5/3) loamy sand, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; some sand grains coated with oriented clay, some with carbonate; strongly effervescent; clear wavy boundary.

Btk2—18 to 31 cm; reddish brown (5YR 5.5/3) fine sandy loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; hard, very friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; some sand grains coated with oriented clay, some with carbonate; few carbonate filaments; strongly effervescent; clear wavy boundary.

K21—31 to 48 cm; pinkish white (7.5YR 9/3) sandy clay loam, pinkish white (7.5YR 8/3) moist; a lesser amount 7.5YR 7/3 dry; weak medium subangular blocky structure; hard and extremely hard, friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K22—48 to 65 cm; pinkish white (7.5YR 8/2) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount 5YR 6/4; weak medium subangular blocky structure; extremely hard, friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; strongly effervescent; clear smooth boundary.

K31—65 to 85 cm; pinkish gray to pink (7.5YR 7.5/3) fine sandy loam, pinkish gray to light brown (7.5YR 6/3) moist; a lesser amount 7.5YR 9/2; weak medium subangular blocky structure; extremely hard, friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K32—85 to 114 cm; pinkish gray to pink (7.5YR 7/3) fine sandy loam, pinkish gray to light brown (7.5YR 6/3) moist; a lesser amount 7.5YR 9/2; weak medium subangular blocky structure; extremely hard, friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K33—114 to 141 cm; pink (5YR 7/3) fine sandy loam, reddish brown (5YR 5/4) moist; a lesser amount darker or lighter; weak medium subangular blocky structure; extremely hard, friable; very few fine roots; few insect burrows, 1 to 10 mm in diameter, some empty and some filled with fine earth; strongly effervescent.

1997 Sampling

K34—141 to 151 cm; fine sandy loam about equal parts pink (7.5YR 7/4), brown (7.5YR 5.5/4) moist, and pinkish white (7.5YR 8/2), pinkish gray (7.5YR 7/2) moist; weak medium and coarse subangular blocky structure; very hard, firm; strongly effervescent; abrupt wavy boundary.

Btk1b—151 to 160 cm; reddish yellow (5YR 6/6) silica-cemented sand with a lesser amount of soft loamy sand, 5YR 6/3, occurring between the peds; yellowish red (5YR 5/6) moist; weak coarse and very coarse subangular blocky structure; very hard and extremely hard; very firm and extremely firm; peds coated with carbonate; most coatings are continuous and less than 1 mm thick; ped interiors noncalcareous, carbonate coatings strongly effervescent; clear wavy boundary.

Btk2b—160 to 171 cm; light reddish brown (5YR 6/3) clay loam, reddish brown (5YR 5/3) moist; moderate fine and medium subangular blocky structure; very hard, very firm; few carbonate nodules; some peds have black (Mn, Fe?) filaments and partial coatings; some have a few threadlike mottles, 5YR 6/8; a lesser amount

7.5YR 6/3; most ped interiors noncalcareous, carbonate coatings and nodules strongly effervescent; clear wavy boundary.

Btk3b—171 to 191 cm; yellowish red (5YR 5-5/5) very fine sandy loam, yellowish red (5YR 4/5) moist; moderate fine and medium subangular blocky structure; very hard; very firm; few carbonate nodules; some peds have black (Mn, Fe?) filaments and partial coatings; some have a few threadlike mottles, 5YR 6/8; a lesser amount 7.5YR 6/3; most ped interiors noncalcareous, carbonate coatings and nodules strongly effervescent; clear wavy boundary.

Btk4b—191 to 203 cm; pinkish gray to pink (7.5YR 7/3) fine sandy loam, brown (7.5YR 4.5/3) moist; weak fine subangular blocky structure; slightly hard and hard, firm; few carbonate nodules; some peds 5YR 5/4; generally strongly effervescent, but noncalcareous interiors in some peds; clear wavy boundary.

K21b—203 to 221 cm; white (7.5YR 9/1) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium subangular blocky structure; extremely hard, extremely firm; strongly effervescent; clear wavy boundary.

K22b—221 to 239 cm; pinkish white (7.5YR 8/2) fine sandy loam, pink (7.5YR 7/4) moist; weak fine and medium subangular blocky structure; extremely hard and very hard, very firm; strongly effervescent; clear wavy boundary.

K23b—239 to 256 cm; pinkish white (7.5YR 8/2) loam, pink (7.5YR 7/4) moist; weak fine and medium subangular blocky structure; extremely and very hard, very firm; strongly effervescent; clear wavy boundary.

K24b—256 to 289 cm; pinkish white (7.5YR 8/3) fine sandy loam, pink (7.5YR 7/4) moist; weak fine and medium subangular blocky structure; very hard, very firm; strongly effervescent; clear wavy boundary.

K25b—289 to 321 cm; pinkish white (7.5YR 8/2) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium and coarse subangular blocky structure; extremely hard and very hard, very firm; some peds are 7.5YR 6/3 and have noncalcareous interiors, otherwise strongly effervescent; clear wavy boundary.

K26b—321 to 335 cm; pinkish white (7.5YR 3/3) silt loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium subangular blocky structure; hard and very hard, firm; strongly effervescent.

1998 Sampling

Ckb—335 to 355 cm; pinkish white (8YR 8/2) silt loam, light brown (8YR 6/4) moist; weak medium subangular blocky structure; soft and slightly hard, very friable; few fine gypsum crystals; few fine carbonate nodules and grain coatings; noncalcareous and slightly effervescent; abrupt wavy boundary.

Bkyb—355 to 376 cm; pinkish white (8YR 8/2) silt loam, pinkish gray to light brown (8YR 6/3) moist; weak coarse subangular blocky structure; extremely hard, firm; this horizon cemented to underlying gypsum; few fine carbonate nodules and carbonate-coated grains; some parts have weak thin and very thin plates of gypsum; noncalcareous and slightly effervescent; abrupt wavy boundary.

By1b—376 to 381 cm; mostly clear gypsum that commonly is stained and/or separated by parts like the adjacent horizons; moderate coarse angular blocky structure; extremely hard, extremely firm; noncalcareous; abrupt wavy boundary.

By2b—381 to 401 cm; reddish brown (5YR 4.5/4) clay, reddish brown (5YR 4/4) moist; strong medium and coarse angular blocky structure; extremely hard, firm; some peds discontinuously coated with black (Mn, Fe?); noncalcareous; clear wavy boundary.

By3b—401 to 421 cm; reddish brown (5YR 4.5/4) clay, reddish brown (5YR 4/4) moist; strong medium and coarse angular blocky structure; extremely hard, firm; very few fine carbonate nodules and a few parts pinkish white (8YR 8/2); common carbonate nodules and common black (Mn, Fe?) filaments and coatings; carbonate nodules strongly effervescent and other parts noncalcareous or slightly effervescent; abrupt wavy boundary.

Cb—421 to 446 cm; pinkish gray to light brown (7.5YR 6/3) clay, brown (5YR 5/3) moist; strong medium and coarse angular blocky structure; extremely hard, firm; common carbonate nodules and common black (Mn, Fe?) filaments and coatings; carbonate nodules strongly effervescent and other parts noncalcareous or slightly effervescent.

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 455, SAMPLES 95P 3343-3350
- GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	DEPTH (CM)	HORIZON	-1- (- - -TOTAL - - -) CLAY LT .002	-2- SILT .002 -.05	-3- SAND .05 -2	-4- (- -CLAY- -) FINE LT .0002	-5- CO3 LT .002	-6- (- -SILT- -) FINE .002 -.02	-7- COARSE .02 -.05	-8- (- - - - -SAND- - - - - -) VF .05 -.10	-9- F .10 -.25	-10- M .25 -.50	-11- C .5 -1	-12- VC 1 -2	-13- (-COARSE FRACTIONS(MM)-) - - - - WEIGHT - - - - 2 -5	-14- 5 -20	-15- 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
95P3343S	0- 5	A	10.4	11.4	78.2			4.3	7.1	11.3	37.1	26.2	3.3	0.3	TR	TR	--	67	TR
95P3344S	5- 18	Btk1	8.9	10.6	80.5		2.1	5.0	5.6	10.5	38.7	28.6	2.5	0.2	TR	--	--	70	--
95P3345S	18- 31	Btk2	12.3	11.2	76.5		2.6	4.3	6.9	9.4	34.8	27.4	4.2	0.7	1	TR	--	67	1
95P3346S	31- 48	K21	21.3	15.8	62.9		13.2	9.4	6.4	9.6	27.3	21.0	3.7	1.3	1	1	--	54	2
95P3347S	48- 65	K22	18.6	14.0	67.4		10.5	8.2	5.8	10.9	30.9	21.3	3.4	0.9	1	TR	--	57	1
95P3348S	65- 85	K31	15.8	13.6	70.6		7.5	8.2	5.4	11.4	32.6	22.3	3.3	1.0	1	TR	--	60	1
95P3349S	85-114	K32	13.3	13.7	73.0		4.8	8.4	5.3	11.4	33.5	23.8	3.6	0.7	1	1	--	62	2
95P3350S	114-141	K33	13.3	12.3	74.4			6.4	5.9	10.9	33.3	25.4	3.9	0.9	1	TR	--	64	1

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c	(- - DITH-CIT - -) EXTRACTABLE FE 6C2b	AL 6G7a	MN 6D2a	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A5	1/3 BAR 4A1d	OVEN DRY 4A1h	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1c	1/3 BAR 4B1c	15 BAR 4B2a	WRD WHOLE SOIL 4C1
				<- PERCENT OF <2MM ->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
0- 5	0.29							0.84	0.42										4.4	
5- 18	0.27							0.81	0.47										4.2	
18- 31	0.28							0.68	0.41										5.1	
31- 48	0.25							0.34	0.32										6.9	
48- 65	0.09							0.35	0.58										10.8	
65- 85	0.04							0.41	0.34										5.3	
85-114	0.04							0.50	0.39										5.2	
114-141	0.02							0.56	0.44										5.8	

AVERAGES, DEPTH 18- 31: PCT CLAY 10 PCT .1-75MM 67

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 455, SAMPLE 95P 3343-3350

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5		1.2	0.2	0.6					8.7	2		100	100	4					7.9	8.5
5- 18		1.0	0.1	0.4					7.2	1		100	100	5					7.9	8.5
18- 31		1.3	0.1	0.3					8.4	2		100	100	8					7.8	8.4
31- 48		1.6	0.2	0.2					7.2	3		100	100	25					7.8	8.3
48- 65		1.8	0.2	0.2					6.5	3		100	100	22					7.8	8.3
65- 85		2.1	0.3	0.2					6.5	5		100	100	17					8.0	8.5
85-114		2.5	0.8	0.2					6.7	10	6	100	100	12				8.2	7.9	8.7
114-141		3.1	1.7	0.2					7.5	17	11	100	100	9		--		8.1	8.0	8.7

	(- - - WATER EXTRACTED FROM SATURATED PASTE - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.17
5- 18																		0.15
18- 31																		0.15
31- 48																		0.22
48- 65																		0.20
65- 85																		0.19
85-114	1.3	0.6	5.5	TR	--	2.0	0.4	1.5				3.4	--	0.4	35.8	TR	0.83	0.30
114-141	2.1	1.2	14.3	0.1	--	2.0	0.5	7.3				6.9	--	2.2	33.5	TR	1.94	0.57

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003A PRINT DATE 03/04/02

SSL - PROJECT 97P 53, (RP97NM077) DONA ANA
- PEDON 97P 343, SAMPLES 97P 2077-2087
- GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	DEPTH (CM)	HORIZON	-4- CLAY LT .002	-5- SILT .002 -.05	-6- SAND .05 -2	-7- FINE CLAY LT .0002	-8- CO3 LT .002	-9- FINE SILT .002 -.02	-10- COARSE SILT .02 -.05	-11- VF SAND .05 -.10	-12- F SAND .10 -.25	-13- M SAND .25 -.50	-14- C SAND .5 -1	-15- VC SAND 1 -2	-16- WEIGHT 2 -5	-17- WEIGHT 5 -20	-18- WEIGHT 20 -75	-19- WEIGHT .1- 75	-20- WT PCT OF WHOLE SOIL (>2MM)
			<- - - PCT OF <2MM (3A1)											- - ->	<- PCT OF <75MM(3B1)->				
97P2077N	141-151	K34	16.0	15.3	68.7		5.6	9.6	5.7	9.4	30.7	23.9	3.8	0.9					
97P2078N	151-160	Btk1b	4.0	9.9	86.1		1.8	5.8	4.1	5.8	17.1	56.3	6.4	0.5					
97P2079N	160-177	Btk2b	29.1	30.4	40.5		1.8	24.3	6.1	4.9	12.0	18.5	3.8	1.3					
97P2080N	177-191	Btk3b	16.9	29.6	53.5		1.3	17.4	12.2	16.1	23.0	9.2	3.7	1.5					
97P2081N	191-203	Btk4b	10.2	25.8	64.0		1.9	17.3	8.5	16.8	25.2	12.7	5.9	3.4					
97P2082N	203-221	K21b	12.7	31.6	55.7		6.0	23.6	8.0	15.6	25.4	10.4	3.2	1.1					
97P2083N	221-239	K22b	10.2	26.4	63.4		4.9	17.2	9.2	19.3	29.9	11.0	2.4	0.8					
97P2084N	239-256	K23b	12.3	38.5	49.2		5.1	26.4	12.1	17.1	22.6	6.9	1.8	0.8					
97P2085N	256-289	K24b	6.3	46.8	46.9		2.1	34.3	12.5	17.6	20.3	6.1	2.1	0.8					
97P2086N	289-321	K25b	11.2	33.3	55.5		1.8	21.1	12.2	18.5	25.3	8.6	2.2	0.9					
97P2087N	321-335	K26b	5.2	54.9	39.9		1.8	37.3	17.6	16.1	15.6	5.0	2.1	1.1					

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c	DITH-CIT EXTRACTABLE FE 6C2b <- PERCENT	DITH-CIT EXTRACTABLE AL 6G7a OF	DITH-CIT EXTRACTABLE MN 6D2a <2MM ->	(RATIO/CLAY) CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	ATTERBERG LIMITS LL 4F1 PCT <0.4MM	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A5 <- - G/CC	BULK DENSITY 1/3 BAR 4A1d	BULK DENSITY OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	WATER CONTENT FIELD MOIST 4B4 <- - -PCT OF	WATER CONTENT 1/10 BAR 4B1c	WATER CONTENT 1/3 BAR 4B1c <2MM	WATER CONTENT 15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
141-151	0.09							0.53	0.43										6.9	
151-160	0.03							3.80	1.83										7.3	
160-177	0.05							1.14	0.53										15.3	
177-191	0.03							1.99	1.04										17.6	
191-203	0.05							3.29	1.83										18.7	
203-221	0.06							1.62	1.06										13.4	
221-239	0.03							2.00	1.25										12.7	
239-256	0.04							1.72	1.12										13.8	
256-289	0.05							2.89	1.68										10.6	
289-321	0.03							2.11	1.21										13.6	
321-335	0.05							3.02	1.56										8.1	

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003A PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 343, SAMPLE 97P 2077-2087

DEPTH (CM)	-1- CA 5B5a 6N2e	-2- MG 5B5a 6O2d	-3- NA 5B5a 6P2b	-4- K 5B5a 6Q2b	-5- SUM BASES	-6- ACID-ITY 6H5a	-7-	-8- CEC SUM CATS 5A3a	-9- CEC NH4-OAC 5A8b	-10- EXCH NA 5D2 PCT	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1g	-15- CARBONATE AS CACO3 <20MM 6E4	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f 1:2	-20- PH H2O 8C1f 1:1
	<- - -	- - -	- - -	-MEQ /	100 G	- - -	- - -	- - -	- ->			<- -PCT-	>	<- -PCT	->	<- -PCT	->			
141-151		4.0	2.6	0.2					8.5	19	15	100	100	15		--		8.1	8.0	8.5
151-160		5.3	4.1	0.3					15.2	22	21	100	100	2		--		8.0	8.1	8.7
160-177		11.8	9.4	0.6					33.2	25	20	100	100	7		--		7.8	8.2	8.4
177-191		12.4	10.4	0.9					33.6	24	19	100	100	1		--		7.8	8.1	8.3
191-203		12.5	11.0	0.9					33.6	22	17	100	100	7		--		7.5	8.0	8.0
203-221		8.3	7.9	0.6					20.6	24	16	100	100	28		TR		7.6	7.9	8.0
221-239		8.6	8.5	0.6					20.4	26	16	100	100	18		TR		7.7	7.8	7.9
239-256		9.9	9.7	0.1					21.2	29	17	100	100	26		--		7.7	7.9	8.0
256-289		7.1	7.4	0.4					18.2	26	16	100	100	29		--		7.7	8.1	8.3
289-321		9.0	9.8	0.5					23.6	28	18	100	100	8		--		7.7	8.0	8.1
321-335		6.0	6.6	0.4					15.7	24	16	100	100	39		--		7.9	8.2	8.8

(- - - - - - - - WATER EXTRACTED FROM SATURATED PASTE - - - - - - - -)

DEPTH (CM)	CA 6N1b	MG 6O1b	NA 6P1b	K 6Q1b	CO3 6I1b	HCO3 6J1b	F 6U1b	CL 6K1d	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1d	NO2 6W1b	NO3 6M1d	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - -	- - -	- - -	- - -	- - -	- - -	MEQ /	LITER	- - -	- - -	- - -	- - -	- - -	- ->	<- -PCT-	->		
141-151	2.8	1.7	22.8	0.1	--	1.7	TR	15.2				5.0	--	7.0	42.3	0.1	3.05	0.83
151-160	1.2	0.7	20.0	0.1	--	2.5	TR	11.7				5.8	--	2.2	38.7	0.1	2.43	0.65
160-177	2.5	1.6	28.0	0.1	--	2.1	--	13.9				11.7	--	--	43.8	0.1	3.53	1.21
177-191	5.6	3.6	39.9	0.2	--	1.7	--	15.3				25.3	--	3.1	54.6	0.2	5.08	1.60
191-203	20.5	12.5	67.7	0.3	--	1.3	--	23.6				78.3	--	--	54.7	0.4	8.80	2.94
203-221	21.2	11.4	65.7	0.3	--	1.1	--	24.4				82.3	--	--	44.3	0.3	8.61	3.98
221-239	22.5	12.3	67.3	0.3	--	1.2	--	22.4				82.8	--	--	46.9	0.3	9.12	4.28
239-256	21.5	12.0	69.6	0.3	--	1.2	--	24.4				84.6	--	--	50.4	0.4	9.02	3.70
256-289	20.2	11.7	62.9	0.3	--	1.2	--	18.2				82.3	--	--	42.6	0.3	8.36	3.04
289-321	19.6	12.4	72.2	0.3	--	1.3	--	23.4				84.5	--	--	44.7	0.3	9.14	2.88
321-335	12.7	7.4	50.4	0.2	--	1.4	--	12.4				60.8	--	--	56.2	0.3	6.57	2.08

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003B PRINT DATE 03/04/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 227, SAMPLES 99P 1191-1196
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
99P1191N	335-355	Ckb	4.8	50.5	44.7			23.3	27.2	25.5	13.4	4.1	1.5	0.2					
99P1192S	355-376	Bkyb	8.3	59.1	32.6			36.6	22.6	11.1	7.3	6.5	6.7	1.0	--	--	--	21	--
99P1193S	376-381	By1b	7.5	38.5	54.0			32.6	5.9	4.7	10.8	14.9	17.5	6.1	--	--	--	49	--
99P1194S	381-401	By2b	59.5	39.9	0.6			38.6	1.3	0.3	0.2	0.1	TR	--	--	--	--	TR	--
99P1195S	401-421	By3b	64.3	30.3	5.4			26.0	4.3	2.9	2.1	0.3	0.1	--	--	--	--	2	--
99P1196S	421-446	Cb	60.5	34.2	5.3			31.5	2.7	2.5	2.2	0.5	0.1	TR	--	--	--	3	--

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2h	6G7g	6D2g	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT OF <2MM —>						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
335-355								4.25	2.02										9.7	
355-376								1.76	2.19										18.2	
376-381								0.97	3.19										23.9	
381-401								0.80	0.41										24.6	
401-421								0.76	0.42										27.2	
421-446								0.74	0.41										24.9	

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003B PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 227, SAMPLE 99P 1191-1196

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2i	6O2h	6P2f	6Q2f		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1h	6E4b	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
335-355		6.6	8.2	0.2					20.4	27	16	100	100	7		TR		7.8	8.0	8.2
355-376		4.6	5.3	0.3		--			14.6	20	13	100	100	1		39		7.7	7.7	7.8
376-381		2.3	2.6	0.1		0.1			7.3	9	9		100	1		72		7.7	7.8	7.9
381-401	76.3	15.3	15.8	1.3	108.7	--		108.7	47.8	19	14	100	100	TR		1		7.6	7.8	7.9
401-421		16.1	16.1	1.4		--			49.0	19	14	100	100	1		2		7.6	7.8	7.9
421-446		14.9	15.0	1.2		--			44.8	20	14	100	100	6		--		7.1	8.1	8.3

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1d	6O1d	6P1d	6Q1d	6I1b	6J1b	6U1c	6K1e	6S9a	6X1a	6Y1a	6L1e	6W1c	6M1e	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - - MEQ / LITER ->														<- -PCT-	->	/cm	/cm
335-355	20.7	13.7	67.6	0.3	--	1.5	--	14.6				81.2	--	--	39.0	0.3	8.49	4.13
355-376	20.0	12.5	53.9	0.4	--	1.5	0.2	12.3				74.6	--	--	44.5	0.3	7.32	4.30
376-381	22.6	11.1	38.9	0.5	--	1.4	TR	8.9				62.9	--	--	50.5	0.2	5.95	3.43
381-401	22.2	14.6	60.4	0.7	--	1.4	0.2	16.5				81.0	--	0.8	108.3	0.7	8.10	6.40
401-421	21.6	14.5	60.0	0.6	--	1.2	0.2	16.5				78.9	--	1.1	114.0	0.7	8.03	6.74
421-446	15.1	10.6	51.7	0.5	--	1.2	0.2	14.8				63.0	--	1.0	117.9	0.6	6.89	4.50

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, calcareous analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-003B PRINT DATE 03/13/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 227, SAMPLES 99P 1191-1196
- GENERAL METHODS 1B1A, 2A1, 2B

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
		ACID OXALATE	EXTRACTION			PHOSPHOUS		KCL	TOTAL	(- -WATER	CONTENT-	-)(	- - -	- WATER DISPERSIBLE	- - -	-)				MIN	AGGRT
		OPT	FE	SI	AL		CIT-	MN	C	0.06	1-	2-	15	<- - PIPETTE	- - ><	- HYDROMETER	- - >			SOIL	STABL
		DEN				RET	ACID			BAR	BAR	BAR	BAR	CLAY	SILT	SAND	CLAY	SILT	SAND	CONT	<5mm
SAMPLE	HZ	8J1c	6C9b	6V2b	6G12b	6S4d	6S5	6D3b	6A2e	4B1c	4B1a	4B1a	4B2b	<- - -	3A1c	- - -><-	- - -	SML	- - ->	8F1	4G1
NO.	NO		<- P C T	of < 2	m m ->	<- P P M	-><- -			- - - -	- - - -	- - - -	- P E R	C E N T	of	< 2 m m	- - - -	- - - -	- - - -	><20mm>	< PCT>
99P1191	1								0.78												
99P1192	2								0.07												
99P1193	3								0.06												
99P1194	4								0.06												
99P1195	5								0.05												
99P1196	6								0.66												

Soil series: Hueco
Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid
Soil survey number: S95NM-013-004
Location: NW¼NE¼NW¼ sec. 3, T. 20 S., R. 1 E., 55 m north of road
Elevation: 4,340 feet, 1,323 m
Landform: Level basin floor
Geomorphic surface: La Mesa
Parent material: Upper Camp Rice Formation (fluvial facies) sand
Vegetation: Mesquite, black grama, soaptree yucca
Described and sampled by: L.H. Gile
Date: Horizons from 0 to 370 cm (202 to 370 cm in an offset pedon)—March 12, 1995; horizons from 202 to 283 cm—December 30, 1996; horizons from 373 to 545 cm—November 1, 1998; all horizons sampled from the west end of the study trench, south side, except for 202 to 370 cm, an offset pedon on the east end

1995 Sampling

A—0 to 6 cm; yellowish red (5YR 5.5/5) sand, yellowish red (5YR 4/5) moist; massive and single grain; soft, loose, very friable; common fine roots; noncalcareous; abrupt smooth boundary.

BAt—6 to 15 cm; yellowish red (5YR 5.5/5) loamy sand, yellowish red (5YR 4/5) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Bt1—15 to 28 cm; yellowish red (5YR 5/5) loamy sand, yellowish red (5YR 4/5) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; few very fine roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Bt2—28 to 43 cm; yellowish red (5YR 5.5/5) loamy sand, yellowish red (5YR 4.5/5) moist; weak medium subangular blocky structure; slightly hard and hard, very friable; few very fine roots; sand grains coated with oriented clay; noncalcareous; clear wavy boundary.

Bt3—43 to 57 cm; yellowish red (5YR 5.5/5) fine sandy loam, yellowish red (5YR 4.5/5) moist; weak coarse subangular blocky structure; hard, very friable; few very fine roots; sand grains coated with oriented clay; few insect burrows, 2 to 10 mm in diameter, some empty and some filled with fine earth; noncalcareous; clear wavy boundary.

Btk1—57 to 74 cm; reddish brown (5YR 5.5/4) sandy loam, reddish brown (5YR 4/4) moist; weak coarse subangular blocky structure; hard, very friable; few very fine roots; common carbonate filaments; sand grains coated with oriented clay; strongly effervescent; clear wavy boundary.

Btk2—74 to 83 cm; yellowish red (5YR 5.5/5) sandy loam, yellowish red (5YR 4.5/5) moist; weak coarse subangular blocky structure; hard, very friable; few very fine roots; common carbonate filaments; sand grains coated with oriented clay; few insect burrows, 1 to 5 mm in diameter, some empty and some filled with fine earth; strongly effervescent; clear wavy boundary.

K1t—83 to 89 cm; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; hard, very friable; very few very fine roots; common carbonate nodules; strongly effervescent; abrupt smooth boundary.

K21m—89 to 104 cm; horizon consisting of a laminar subhorizon commonly ranging from about 1 to 3 cm thick, dominantly pinkish white (7.5YR 8/2), pink (7.5YR 7/4) moist, with a lesser amount slightly darker or lighter than this, and an underlying attached plugged horizon, dominantly 7.5YR 8/3; breaks with a hammer into massive and subangular blocky forms; extremely hard; top of horizon stained with reddish brown clay; strongly effervescent; abrupt smooth boundary.

K22m—104 to 114 cm; horizon consisting of a laminar subhorizon commonly ranging from about 1 to 3 cm thick, dominantly pink (7.5YR 7/4), light brown (7.5YR 5.5/4), moist, with a lesser amount of laminae that are darker or lighter than this, and an underlying attached plugged horizon, dominantly 7.5YR 9/2; in places some of the laminae split and descend into the underlying plugged horizon; extremely hard; strongly effervescent; abrupt smooth boundary.

K23m—114 to 122 cm; horizon consisting of a laminar subhorizon ranging from about 1 to 3 cm thick, dominantly pink (7.5YR 7/4), light brown (7.5YR 5.5/4), moist, and an underlying attached plugged horizon, dominantly 10YR 9/2; extremely hard; strongly effervescent; abrupt smooth boundary.

K24m—122 to 134 cm; dominantly white (10YR 9/2) carbonate-cemented material, white (10YR 8/2) moist, that is generally topped by a laminar horizon that is only 1 to several mm thick but that laterally thickens to 1 cm or more; extremely hard; very few very fine roots; strongly effervescent; abrupt smooth boundary.

K25m—134 to 153 cm; very pale brown (10YR 9/3) carbonate-cemented material, very pale brown (10YR 8/3) moist; massive; extremely hard; very few fine roots; strongly effervescent; abrupt smooth boundary.

K26m—153 to 175 cm; very pale brown (10YR 9/3) carbonate-cemented material, very pale brown (10YR 8/3) moist; although the horizon is continuously indurated, it has cracks ranging from 1 to 4 mm wide; massive; extremely hard; very few fine roots; strongly effervescent; abrupt smooth boundary.

K31—175 to 202 cm; fine earth that is pinkish white (7.5YR 8/2), light brown (7.5YR 6.5/4) moist; carbonate-cemented material that is 10YR 9/2 dry; coarse and very coarse subangular blocky structure; extremely hard, extremely firm; very few fine roots; blocks readily broken out by hand or hammer; strongly effervescent; clear wavy boundary.

K32—202 to 232 cm; pinkish white (7.5YR 8/3) very gravelly sand, pink (7.5YR 7/4) moist; coarse and very coarse subangular blocky structure; extremely hard, soft; gravel consisting of carbonate nodules ranging from 1 to 5 cm; nodule surfaces are cracked; strongly effervescent; clear wavy boundary.

K33t—232 to 254 cm; very pale brown (10YR 9/3) carbonate-cemented material, very pale brown (10YR 8/3) moist; coarse and very coarse subangular blocky structure; extremely hard, soft; gravel as in K32 horizon; blocks of B horizon material, 5YR 6/3 dry; strongly effervescent; clear wavy boundary.

K34t—254 to 271 cm; pink (7.5YR 9/3) very gravelly sand, pink (7.5YR 8/4) moist; coarse and very coarse subangular blocky structure; extremely hard, fine earth soft; horizon has both carbonate nodules and blocks and plates of B horizon material; blocks and plates are commonly carbonate coated but noncalcareous or have little carbonate in their interiors; strongly effervescent; clear wavy boundary.

K35t—271 to 290 cm; pinkish gray to pink (7.5YR 8/3) very gravelly sand, pinkish gray to pink (7.5YR 7/3) moist; coarse and very coarse subangular blocky structure; nodules extremely hard, fine earth soft; some blocks of B horizon material; strongly effervescent; clear wavy boundary.

K36—290 to 317 cm; pinkish gray to pink (7.5YR 8/3) very gravelly sand, pinkish gray to pink (7.5YR 7/3) moist; extremely hard, fine earth soft; strongly effervescent; abrupt smooth boundary.

Bqk1—317 to 323 cm; pinkish gray (7.5YR 7.5/2), sandy material, light brown (7.5YR 6/4) moist; partly cemented by silica; massive; extremely hard; some of the sands are fragments of pumice; breaks out with hammer as plates and blocks 1 to 6 cm thick; plates and blocks commonly coated with carbonate; some parts strongly effervescent and other parts noncalcareous; clear wavy boundary.

Bqk2—323 to 354 cm; pinkish gray (7.5YR 7.5/2), sandy material, light brown (7.5YR 6/4) moist; partly cemented by silica; massive; extremely hard; some of the sands are fragments of pumice; breaks out as medium and coarse blocks; some parts noncalcareous and other parts weakly effervescent; clear wavy boundary.

Bqk3—354 to 370 cm; pinkish gray to pink (7.5YR 7/3), sandy material, brown (7.5YR 5/4) moist; partly cemented by silica; massive; extremely hard; some of the sands are fragments of pumice; light colored salts, both calcareous and noncalcareous, occurring as discontinuous coatings on the blocks and, in places, inside them.

1996 Sampling

K32—202 to 228 cm; pinkish white (7.5YR 8/2) very gravelly sand, light brown (7.5YR 6.5/4) moist; massive and single grain; soft and loose, very friable; gravel consisting of carbonate-cemented nodules; strongly effervescent; abrupt wavy boundary.

Bqk1—228 to 261 cm; pinkish gray to pink (7.5YR 7/3) silica-cemented material, brown (7.5YR 5/3) moist; a lesser amount slightly lighter or darker; partly massive and partly weak and moderate medium and thick platy; extremely hard, extremely firm; some parts strongly effervescent and other parts noncalcareous; the top of the horizon commonly coated with carbonate ranging up to 2 cm thick; carbonate also occurring as fillings between plates and in vertical cracks; clear wavy boundary.

Bqk2—261 to 282 cm; pinkish white (7.5YR 8/2) very gravelly sand, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount slightly lighter or darker; massive; soft, very friable; gravel consisting of carbonate-cemented nodules; strongly effervescent; clear wavy boundary.

Bqk3—282 to 301 cm; pinkish gray to light brown (7.5YR 6/3) silica-cemented material, brown to dark brown (7.5YR 4.5/3) moist; a lesser amount slightly lighter or darker; weak coarse subangular blocky structure; extremely hard, extremely firm; strongly effervescent; clear wavy boundary.

very coarse sand size, and a few grains up to about 5 mm in diameter; strongly effervescent; clear wavy boundary.

Ck2—401 to 409 cm; white (10YR 8/2) fine sand, light brownish gray (10YR 6.5/2) moist; massive; soft, very friable; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; very few hard parts; some grains coated with carbonate; a few fine weakly cemented parts; strongly effervescent; abrupt wavy boundary.

Ck3—409 to 429 cm; white (10YR 8/2) loamy sand, very pale brown (10YR 7/3) moist; massive; hard and very hard, very firm; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; vertical and nearly vertical carbonate veins breaking out as plates up to 8 cm in diameter and 2 to 3 cm thick in parts of the horizon; strongly effervescent; abrupt wavy boundary.

C1´—429 to 434 cm; very pale brown (10YR 7/4) gravelly sand, yellowish brown (10YR 5/4) moist; massive and single grain; soft and loose, very friable; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; generally noncalcareous; abrupt smooth boundary.

C2´ (fine earth)—434 to 475 cm; mostly light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; few carbonate-filled root casts, 1 to 5 mm in diameter; generally noncalcareous; abrupt smooth boundary.

C2´ (indurated parts)—434 to 475 cm; mostly light gray (10YR 7/2) indurated material, grayish brown (10YR 5/2) moist; massive; extremely hard, extremely firm; indurated, elongated and rounded nodular forms that tend to be flattish, ranging from 3 to 10 cm across, 2 to 5 cm thick, and 5 to 25 cm long; in places, indurated plates, 1 to 5 cm thick and 20 to 30 cm wide, form the top of the horizon; these plates and nodular forms occupy about 20 percent of the horizon; strongly effervescent; abrupt wavy boundary.

C3—475 to 515 cm; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; small amounts of carbonate and white noncalcareous salts occurring in root casts 1 to 5 mm thick; noncalcareous, except for the calcareous part of root cast fillings; abrupt smooth boundary.

C4—515 to 545 cm; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; scattered white (10YR 9/2) pumice grains, mostly medium, coarse, and very coarse sand size, and a few grains up to about 5 mm in diameter; small amounts of carbonate and white noncalcareous salts occurring as root channel linings 1 to 5 mm thick, fewer than above; noncalcareous, except for the calcareous part of some root cast fillings.

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 456, SAMPLES 95P 3351-3373
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -		- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	- WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - -	- - - -	- - - -	- - - -	PCT OF <2MM	(3A1)	- - - -	- - - -	- - - -	- - - -	- - - -	->	<- PCT OF	<75MM(3B1)		->	SOIL
95P3351S	0- 6	A	3.2	6.8	90.0			2.0	4.8	10.7	41.2	33.3	4.5	0.3	TR	--	--	79	--
95P3352S	6- 15	BAt	9.3	8.8	81.9			2.0	6.8	14.1	37.7	26.2	3.4	0.5	TR	--	--	68	--
95P3353S	15- 28	Bt1	8.4	7.5	84.1			1.9	5.6	10.5	36.5	32.6	4.2	0.3	TR	--	--	74	--
95P3354S	28- 43	Bt2	10.0	7.0	83.0			1.6	5.4	11.1	36.7	29.0	5.7	0.5	--	--	--	72	--
95P3355S	43- 57	Bt3	11.9	8.6	79.5			2.9	5.7	10.2	33.4	29.2	6.1	0.6	TR	--	--	69	--
95P3356S	57- 74	Btk1	15.7	9.7	74.6		2.1	3.7	6.0	9.0	28.9	28.5	7.7	0.5	TR	TR	--	66	TR
95P3357S	74- 83	Btk2	17.5	9.6	72.9		2.9	4.0	5.6	8.7	28.7	27.8	6.9	0.8	1	1	--	65	2
95P3358S	83- 89	K1t	21.4	11.1	67.5		10.8	6.7	4.4	7.5	27.2	25.3	6.7	0.8	1	TR	--	60	1
95P3359S	89-104	K21m	8.7	17.9	73.4		8.8	10.0	7.9	7.7	15.0	14.1	16.3	20.3	--	--	--	66	--
95P3360S	104-114	K22m	10.1	24.0	65.9		10.1	13.6	10.4	9.8	17.3	17.0	14.7	7.1	--	--	--	56	--
95P3361S	114-122	K23m	16.2	27.5	56.3		16.4	17.2	10.3	8.6	13.8	11.7	11.4	10.8	--	--	--	48	--
95P3362S	122-134	K24m	7.8	21.1	71.1		5.6	11.9	9.2	11.7	24.1	18.6	13.6	3.1	--	--	--	59	--

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK	DENSITY -)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM	—>			PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF	<2MM	- ->		CM/CM
0- 6	0.26							1.44	0.59										1.9	
6- 15	0.23							0.85	0.32										3.0	
15- 28	0.14							0.86	0.36										3.0	
28- 43	0.12							0.74	0.36										3.6	
43- 57	0.18							0.71	0.39										4.6	
57- 74	0.09							0.59	0.36										5.7	
74- 83	0.12							0.54	0.37										6.4	
83- 89	0.12							0.35	0.32										6.9	
89-104	0.16							0.38	0.70										6.1	
104-114	0.06							0.28	0.54										5.5	
114-122	0.22							0.16	0.43										7.0	
122-134	0.05							0.28	0.69				1.86	1.87	0.002			11.5	5.4	0.11

AVERAGES, DEPTH 6- 56: PCT CLAY 10

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 456, SAMPLE 95P 3351-3373

DEPTH (CM)	-1- CA 5B5a 6N2e	-2- MG 5B5a 6O2d	-3- NA 5B5a 6P2b	-4- K 5B5a 6Q2b	-5- SUM BASES	-6- ACIDITY 6H5a	-7-	-8- CEC SUM CATS 5A3a	-9- CEC NH4-OAC 5A8c	-10- EXCH NA 5D2 PCT	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1g	-15- CARBONATE AS CACO3 <20MM 6E4	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f 1:2	-20- PH H2O 8C1f 1:1
	<- - - -	- - - -	- - -MEQ	/ 100 G	- - - -	- - - -	- - -	- - - -	- - ->	PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->				
0- 6	6.2	0.9	0.1	0.4	7.6			7.6	4.6	2		100	100	TR					7.5	8.1
6- 15	6.4	1.1	0.1	0.5	8.1			8.1	7.9	2		100	100	TR					7.5	8.2
15- 28	7.2	1.0	0.1	0.5	8.8			8.8	7.2	2		100	100	--					7.8	8.4
28- 43	7.2	1.0	0.1	0.4	8.7			8.7	7.4	2		100	100	TR					7.8	8.4
43- 57	9.3	1.4	0.1	0.4	11.2			11.2	8.5	1		100	100	TR					7.7	8.2
57- 74		2.4	0.2	0.5					9.3	2		100	100	4					7.8	8.3
74- 83		2.8	0.2	0.5					9.5	2	1	100	100	7				7.9	7.9	8.3
83- 89		2.6	0.2	0.3					7.5	2	1	100	100	21				7.8	7.9	8.3
89-104		2.0	0.3	0.2					3.3	7	1	100	100	90				8.1	8.1	8.4
104-114		2.3	0.3	0.2					2.8	8	2	100	100	88				8.3	8.1	8.7
114-122		2.4	0.3	0.3					2.6	7	2	100	100	88				8.5	8.0	8.6
122-134		2.7	0.4	0.2					2.2	11	2	100	100	70				8.2	8.2	8.6

(- - - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -) PRED.

DEPTH (CM)	CA 6N1b	MG 6O1b	NA 6P1b	K 6Q1b	CO3 6I1b	HCO3 6J1b	F 6U1b	CL 6K1d	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1d	NO2 6W1b	NO3 6M1d	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - - -	- - - -	- - - -	- - - -	- - -	- - MEQ	/ LITER	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - ->	<- -PCT- ->			
0- 6																		0.17
6- 15																		0.12
15- 28																		0.12
28- 43																		0.12
43- 57																		0.19
57- 74																		0.23
74- 83	4.8	1.4	1.4	0.3	--	1.1	0.3	3.0				2.1	--	1.6	31.2	TR	0.90	0.28
83- 89	5.2	1.6	1.5	0.2	--	1.4	0.2	1.6				4.3	TR	1.0	30.7	TR	0.90	0.30
89-104	4.4	1.6	2.4	0.3	--	1.7	0.2	2.9				3.1	--	1.0	25.7	TR	0.96	0.34
104-114	3.2	1.7	3.1	0.3	--	1.8	0.3	1.5				4.8	TR	0.4	23.4	TR	0.88	0.33
114-122	3.0	1.6	2.8	0.4	--	1.5	0.4	2.1				3.4	TR	0.5	29.6	TR	0.87	0.37
122-134	4.5	3.2	4.4	0.4	--	1.7	0.3	2.4				8.2	--	0.5	28.2	TR	1.29	0.44

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004 PRINT DATE 03/04/02

SSL - PROJECT 95P 69, (CP95NM150) DONA ANA
- PEDON 95P 456, SAMPLES 95P 3351-3373
- GENERAL METHODS 1B1A, 2A1, 2B

-1- SAMPLE NO.	-2- DEPTH (CM)	-3- HORIZON	-4- TOTAL CLAY LT .002	-5- TOTAL SILT .002 -.05	-6- TOTAL SAND .05 -2	-7- CLAY FINE LT .0002	-8- CLAY CO3 LT .002	-9- SILT FINE .002 -.02	-10- SILT COARSE .02 -.05	-11- SAND VF .05 -.10	-12- SAND F .10 -.25	-13- SAND M .25 -.50	-14- SAND C .5 -1	-15- SAND VC 1 -2	-16- COARSE FRACTIONS (MM) WEIGHT 2 -5	-17- WEIGHT 5 -20	-18- WEIGHT 20 -75	-19- WEIGHT .1- 75	-20- (>2MM) WT PCT OF WHOLE SOIL
			<- - - PCT OF <2MM (3A1)											- - ->	<- PCT OF <75MM(3B1)			->	
95P3363S	134-153	K25m	12.5	18.6	68.9		7.3	11.1	7.5	9.4	17.0	14.4	14.2	13.9	--	--	--	59	--
95P3364S	153-175	K26m	15.0	17.2	67.8		8.2	14.0	3.2	6.2	12.0	14.2	20.4	15.0	--	--	--	62	--
95P3365N	175-202	K31	3.6	9.5	86.9		1.3	4.9	4.6	12.8	30.2	20.4	10.5	13.0					
95P3366N	202-232	K32	4.0	13.2	82.8		1.6	5.5	7.7	14.4	28.3	18.5	8.9	12.7					
95P3367N	232-254	K33t	3.4	11.0	85.6		1.1	5.8	5.2	14.7	29.2	24.2	9.1	8.4					
95P3368N	254-271	K34t	3.3	8.0	88.7		1.3	3.1	4.9	9.3	28.5	22.2	13.1	15.6					
95P3369N	271-290	K35t	2.8	5.0	92.2		0.7	3.2	1.8	4.6	15.4	19.9	20.6	31.7					
95P3370N	290-317	K36	2.2	7.3	90.5		1.0	3.4	3.9	9.9	17.9	17.4	18.8	26.5					
95P3371S	317-323	Bk1	2.3	4.8	92.9		1.0	2.4	2.4	7.9	14.0	20.7	26.3	24.0	TR	2	--	85	2
95P3372S	323-354	Bk2	2.0	3.6	94.4		0.7	1.3	2.3	5.1	16.9	37.0	26.0	9.4	1	TR	--	89	1
95P3373S	354-370	Bk3	1.8	3.5	94.7		0.7	1.3	2.2	3.3	16.4	44.2	20.0	10.8	2	1	--	92	3

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c <- PERCENT	DITH-CIT EXTRACTABLE FE 6C2b	DITH-CIT EXTRACTABLE AL 6G7a OF	DITH-CIT EXTRACTABLE MN 6D2a <2MM -->	(RATIO/CLAY) CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	(ATTERBERG) LIMITS LL 4F1 PCT <0.4MM	(ATTERBERG) LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A5 <- - G/CC	BULK DENSITY 1/3 BAR 4A1d	BULK DENSITY OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	WATER CONTENT FIELD MOIST 4B4 <- - -PCT OF	WATER CONTENT 1/10 BAR 4B1c	WATER CONTENT 1/3 BAR 4B1c <2MM	WATER CONTENT 15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
134-153	0.03							0.22	0.77				1.88	1.92	0.007			10.6	9.6	0.02
153-175	0.01							0.35	1.06				1.67	1.70	0.006			21.2	15.9	0.09
175-202	0.09							3.83	4.42										15.9	
202-232	0.16							2.88	5.00										20.0	
232-254	0.17							3.94	5.47										18.6	
254-271	0.05							5.48	5.36										17.7	
271-290	--							6.39	3.86				1.70	1.73	0.006			13.6	10.8	0.05
290-317	--							6.73	7.45										16.4	
317-323	--							6.35	6.30										14.5	
323-354	--							5.95	3.25				1.81	1.83	0.004			8.0	6.5	0.03
354-370	--							7.39	4.28				1.82	1.84	0.004			8.3	7.7	0.01

AVERAGES, DEPTH 6- 56: PCT CLAY 5

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 456, SAMPLE 95P 3351-3373

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8c	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
134-153		4.8	1.1	0.2					2.7	14	5	100	100	73		--		8.1	8.4	8.5
153-175		8.1	2.3	0.3					5.2	19	8	100	100	89		--		7.9	8.3	8.4
175-202		10.8	3.2	0.6					13.8	15	7	100	100	22		--		7.8	8.0	8.2
202-232		10.7	4.2	0.5					11.5	15	8	100	100	33		1		7.7	7.9	7.9
232-254		12.0	3.8	0.7					13.4	28		100	100	22		4			7.9	7.9
254-271		10.8	1.6	0.9					18.1	6	2	100	100	16		2		7.7	7.8	7.9
271-290		9.5	1.2	1.0					17.9	5	2	100	100	6		--		7.8	7.9	8.2
290-317		7.9	0.9	0.8					14.8	4	2	100	100	9		--		7.4	7.8	8.1
317-323		7.3	0.9	0.8					14.6	5	3	100	100	3				7.9	7.8	8.4
323-354		6.7	0.9	0.7					11.9	6	3	100	100	1				8.1	7.9	8.5
354-370		8.5	0.7	0.8					13.3	5	2	100	100	2				8.0	7.9	8.8

	(- - - - WATER EXTRACTED FROM SATURATED PASTE - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
134-153	10.4	12.5	18.6	0.7	--	1.1	0.8	29.3				13.3	--	2.4	40.2	0.1	3.89	1.18
153-175	13.0	16.3	29.3	0.7	--	1.1	1.3	45.8				15.4	--	--	43.6	0.2	5.38	1.62
175-202	10.0	12.3	23.2	0.5	--	0.8	--	21.5				23.8	--	--	50.1	0.2	4.13	1.53
202-232	35.3	39.5	46.6	0.8	--	0.9	--	77.4				50.9	--	--	52.2	0.4	9.36	4.42
232-254																		4.33
254-271	23.9	16.8	9.9	0.6	--	1.3	1.0	4.4				42.0	--	2.6	53.4	0.1	3.61	2.90
271-290	11.9	8.9	6.1	0.5	--	1.1	0.5	2.3				22.9	--	1.5	49.3	0.1	2.26	0.72
290-317	9.5	6.7	4.9	0.4	--	1.3	0.5	1.8				16.9	--	--	43.6	0.1	1.82	0.65
317-323	2.5	2.1	3.9	0.2	--	1.6	0.2	1.2				5.4	--	0.2	42.9	TR	0.90	0.33
323-354	1.4	1.5	3.9	0.2	--	2.0	0.2	1.1				3.4	--	0.2	38.7	TR	0.74	0.29
354-370	1.4	1.5	2.9	0.2	--	2.0	0.2	1.0				2.7	--	0.2	41.4	TR	0.65	0.26

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 17

ANALYSES: S= ALL ON SIEVED <2mm BASIS N= >2mm FRACTIONS NOT DETERMINED

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004A PRINT DATE 03/04/02

SSL - PROJECT 97P 53, (RP97NM077) DONA ANA
- PEDON 97P 344, SAMPLES 97P 2088-2098
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT			- - - -	WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - -	- - - - - - -	PCT OF <2MM	(3A1)	- - - - -	- - - - -	- - - -	- - -	->	<- PCT OF	<75MM(3B1)		->	SOIL
97P2088N	202-228	K32	2.5	8.4	89.1		1.8	5.1	3.3	12.1	29.3	17.0	13.5	17.2					
97P2089N	228-261	Bqk1	1.2	5.6	93.2		1.0	3.8	1.8	10.5	47.2	13.2	11.2	11.1					
97P2090N	261-282	Bqk2	1.9	11.9	86.2			7.4	4.5	8.1	32.1	21.0	13.9	11.1					
97P2091N	282-301	Bqk3	1.5	8.0	90.5			3.0	5.0	9.8	38.6	20.6	11.4	10.1					
97P2092N	301-317	Bqk4	1.2	11.5	87.3		1.2	5.4	6.1	19.6	28.0	17.7	13.7	8.3					
97P2093N	317-327	Kqm	1.3	16.7	82.0		1.3	8.3	8.4	13.2	18.9	17.5	17.9	14.5					
97P2094S	327-335	Bqm	1.6	10.3	88.1			4.5	5.8	10.1	16.1	28.7	29.2	4.0	6	2	--	80	8
97P2095S	335-351	Bq	0.2	3.2	96.6			1.9	1.3	4.4	18.0	48.8	23.0	2.4	1	1	--	92	2
97P2096S	351-361	K/C	0.3	2.3	97.4		0.3	1.4	0.9	2.5	11.6	52.7	27.1	3.5	4	TR	--	95	4
97P2097S	361-373	C1	0.2	1.9	97.9			1.5	0.4	2.5	20.7	54.3	16.7	3.7	5	9	--	96	14
97P2098S	373-383	C2	TR	2.7	97.3		TR	1.6	1.1	3.1	19.8	41.9	24.0	8.5	--	--	--	94	--

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
202-228	0.14							7.72	7.12										17.8	
228-261	0.04							13.08	8.83										10.6	
261-282	0.08							7.63	6.11										11.6	
282-301	0.01							7.87	4.60										6.9	
301-317	0.03							8.42	5.58										6.7	
317-327	0.06							4.23	2.54										3.3	
327-335	--							5.94	2.75										4.4	
335-351	0.01																		2.1	
351-361	0.01																		0.7	
361-373	0.01																		1.4	
373-383	0.02																		0.5	

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004A   PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 344, SAMPLE 97P 2088-2098

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
202-228		13.9	3.9	1.0					19.3	14	8	100	100	14		--		7.9	7.9	8.1
228-261		10.8	3.3	1.0					15.7	14	7	100	100	4		--		7.8	7.9	8.2
261-282		10.1	2.2	0.8		--			14.5	11	5	100	100	17		--		7.9	8.0	8.3
282-301		7.4	2.0	0.8		0.2			11.8	14	7		100	1				8.2	8.0	8.8
301-317		6.6	1.5	0.7					10.1	11	5	100	100	9		--		8.0	8.0	8.5
317-327		4.2	1.0	0.4					5.5	17		100	100	55		--			8.0	8.2
327-335	4.8	5.3	1.5	0.7	12.3	--		12.3	9.5	13	8	100	100	TR				8.3	8.0	8.7
335-351	2.9	2.5	0.9	0.4	6.7	--		6.7	4.4	15	7	100	100	TR				8.4	8.0	8.5
351-361		2.2	0.5	0.1					1.5	32		100	100	52					8.3	9.1
361-373		2.1	0.7	0.3		0.5			3.1	23			100	1					8.2	8.9
373-383		1.7	0.3	0.1					1.5	19		100	100	58					8.1	9.1

	(- - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
202-228	4.3	5.9	17.8	0.4	--	1.7	--	12.9				15.5	--	--	62.9	0.1	2.90	1.26
228-261	9.3	12.7	22.3	0.6	--	1.4	--	13.0				31.4	--	--	52.0	0.2	4.32	1.37
261-282	5.1	6.8	12.8	0.4	--	1.9	--	4.6				19.1	--	--	46.6	0.1	2.51	0.68
282-301	1.0	1.5	8.2	0.2	--	2.2	0.2	2.2				7.0	--	--	42.1	TR	1.21	0.35
301-317	2.5	4.4	9.0	0.8	--	1.2	0.4	2.4				12.9	--	0.2	34.5	TR	1.52	0.50
317-327																		1.82
327-335	--	2.7	9.4	0.4	--	2.0	0.2	1.9				8.6	--	TR	31.0	TR	1.41	0.36
335-351	1.2	3.3	10.5	0.5	--	1.7	0.3	2.4				11.9	--	--	28.0	TR	1.59	0.31
351-361																		0.17
361-373																		0.20
373-383																		0.07

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 6, 9, 10, 11

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED S= ALL ON SIEVED <2mm BASIS

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004A

PRINT DATE 03/04/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 228, SAMPLES 99P 1197-1205
- GENERAL METHODS 1B1A, 2A1, 2B

-1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS (MM) WEIGHT 2 -5	COARSE FRACTIONS (MM) WEIGHT 5 -20	COARSE FRACTIONS (MM) WEIGHT 20 -75	COARSE FRACTIONS (MM) WEIGHT .1- 75	(>2MM) WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - PCT OF <2MM (3A1)											- - - - - - - - - - - - - ->	<- PCT OF <75MM(3B1)->				
99P1197S	373-391	C2	1.4	1.6	97.0			0.1	1.5	2.1	18.4	42.1	26.6	7.8	5	4	--	95	9
99P1198S	391-401	Ck1	3.3	20.3	76.4		1.3	9.7	10.6	12.5	21.5	22.6	10.9	8.9	TR	TR	--	64	TR
99P1199S	401-409	Ck2	1.3	3.6	95.1			0.3	3.3	8.3	48.6	32.2	5.2	0.8	2	TR	--	87	2
99P1200S	409-429	Ck3	2.3	25.8	71.9			9.0	16.8	10.8	20.1	20.7	12.9	7.4	11	6	--	68	17
99P1201S	429-434	C1'	0.6	1.3	98.1			--	1.3	1.8	33.8	29.5	25.5	7.5	8	10	--	97	18
99P1202S	434-475	C2'	0.2	0.9	98.9			--	0.9	4.4	91.1	3.2	0.2	TR	TR	TR	--	94	TR
99P1203S	434-475	C2'	3.0	22.3	74.7		2.3	10.4	11.9	12.9	31.8	9.3	6.9	13.8	--	--	--	62	--
99P1204S	475-515	C3	0.3	2.3	97.4			0.4	1.9	12.3	77.0	7.1	0.8	0.2	TR	1	--	85	1
99P1205S	515-545	C4	--	1.9	98.1			--	1.9	2.8	66.5	23.9	3.5	1.4	2	1	--	95	3

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c	DITH-CIT EXTRACTABLE FE 6C2h	DITH-CIT EXTRACTABLE AL 6G7g	DITH-CIT EXTRACTABLE MN 6D2g	(RATIO/CLAY) CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	(ATTERBERG LIMITS) LL 4F1	(ATTERBERG LIMITS) PI 4F	(BULK DENSITY) FIELD MOIST 4A5	(BULK DENSITY) 1/3 BAR 4A1d	(BULK DENSITY) OVEN DRY 4A1h	COLE WHOLE SOIL 4D1	(WATER CONTENT) FIELD MOIST 4B4	(WATER CONTENT) 1/10 BAR 4B1c	(WATER CONTENT) 1/3 BAR 4B1c	(WATER CONTENT) 15 BAR 4B2a	WRD WHOLE SOIL 4C1
				<- PERCENT OF <2MM ->						PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
373-391								2.93	1.86										2.6	
391-401								0.88	0.55										1.8	
401-409								3.15	1.85										2.4	
409-429								6.65	3.13										7.2	
429-434																			1.3	
434-475																			1.3	
434-475								0.47	0.43										1.3	
475-515																			1.8	
515-545																			2.9	

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004A PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 228, SAMPLE 99P 1197-1205

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2i	6O2h	6P2f	6Q2f		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1h	6E4b	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
373-391	3.6	2.3	0.5	0.2	6.6	--		6.6	4.1	10	3	100	100	TR				8.2	8.1	8.7
391-401		2.8	0.5	0.2					2.9	14	1	100	100	49		--		8.0	8.1	8.6
401-409		3.2	0.7	0.1		--			4.1	17		100	100	3					8.3	9.0
409-429		10.3	1.7	0.6					15.3	10	5	100	100	21				8.4	8.1	8.7
429-434	6.5	1.7	0.6	0.1	8.9	--		8.9	3.2	19		100	100	TR					8.3	9.0
434-475	1.0	1.6	0.5	TR	3.1	0.1		3.2	2.9	18		97	100	--					7.8	8.3
434-475		2.0	0.4	TR					1.4	21	1	100	100	58				8.0	8.0	8.5
475-515	4.0	2.2	0.7	0.1	7.0	--		7.0	3.8	20		100	100	TR					8.2	9.0
515-545	1.7	1.8	0.8	0.1	4.4	0.1		4.5	3.6	22		98	100	TR					8.2	9.0

	(- - - - WATER EXTRACTED FROM SATURATED PASTE- - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1d	6O1d	6P1d	6Q1d	6I1b	6J1b	6U1c	6K1e	6S9a	6X1a	6Y1a	6L1e	6W1c	6M1e	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
373-391	0.4	1.4	2.6	0.1	--	2.2	0.2	0.7				1.7	TR	0.1	29.9	TR	0.54	0.25
391-401	5.8	7.3	3.2	0.3	--	1.5	0.1	1.0				15.2	--	0.1	23.4	TR	1.49	0.52
401-409																		0.21
409-429	0.3	1.0	4.3	0.1	--	3.4	0.2	0.5				2.0	0.1	0.1	36.8	TR	0.66	0.32
429-434																		0.16
434-475																		0.08
434-475	11.1	8.1	4.5	0.2	--	1.0	0.1	1.5				22.7	--	0.2	23.8	TR	1.96	0.31
475-515																		0.19
515-545																		0.17

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 3, 5, 6, 8, 9

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S95NM-013-004A PRINT DATE 03/13/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 228, SAMPLES 99P 1197-1205
- GENERAL METHODS 1B1A, 2A1, 2B

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
		ACID	OXALATE EXTRACTION			PHOSPHOUS		KCL	TOTAL	(- -WATER CONTENT- -)				(- - - - WATER DISPERSIBLE - - - -)						MIN	AGGRT
		OPT	FE	SI	AL		CIT-	MN	C	0.06	1-	2-	15	<- - PIPETTE - - >			< - HYDROMETER - >			SOIL	STABL
		DEN				RET	ACID			BAR	BAR	BAR	BAR	CLAY	SILT	SAND	CLAY	SILT	SAND	CONT	<5mm
SAMPLE	HZ	8J1c	6C9b	6V2b	6G12b	6S4d	6S5	6D3b	6A2e	4B1c	4B1a	4B1a	4B2b	<- - -	3A1c	- - ->	<- - -	SML	- - ->	8F1	4G1
NO.	NO		<- P C T o f < 2 m m ->			<- P P M ->			< - - - - - - - - - - - P E R C E N T o f < 2 m m - - - - - - - - >											<20mm>	< PCT>
99P1197	1																				
99P1198	2								6.10												
99P1199	3								0.40												
99P1200	4								2.34												
99P1201	5																				
99P1202	6								TR												
99P1203	7								6.89												
99P1204	8								0.01												
99P1205	9								TR												

```
                 Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

                                ***P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A***

S95NM-013-004                                                                                     PRINT DATE 03/11/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 95P 456, SAMPLE 95P 3351-3373

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
_____________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - - >< - - - THERMAL - - - >< - - - - - - - - ELEMENTAL - - - - - - - - >< - -> EGME  INTER
SAMPLE       ION <                              >< - DTA - -> < - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <     > RETN  PRETA
                 < - - - - - -  7A2i - - - - - - >< - 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C4a- - - - - - - - - ><     >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - - >< - - - Percent - - - >< - - - - - - - - - Percent - - - - - - - - >< - -><mg/g>< - ->

95P3354     TCLY  MT 3  MI 3  KK 2  QZ 1
95P3357     TCLY  MT 3  CA 3  MI 2  KK 1
95P3359     TCLY  CA 5  MI 1
95P3360     TCLY  CA 5
95P3361     TCLY  CA 5  QZ 1
95P3362     TCLY  CA 5  MI 1  KK 1  VR 1
_____________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    MT  montmorillon     MI  mica             KK  kaolinite        QZ  quartz           CA  calcite          VR  vermiculite

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
_____________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - - >< - - - THERMAL - - - >< - - - - - - - - ELEMENTAL - - - - - - - - >< - -> EGME  INTER
SAMPLE       ION <                              >< - DTA - -> < - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <     > RETN  PRETA
                 < - - - - - -  7A2i - - - - - - >< - 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C4a- - - - - - - - - ><     >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - - >< - - - Percent - - - >< - - - - - - - - - Percent - - - - - - - - >< - -><mg/g>< - ->

95P3364     TCLY  CA 5  VR 3
95P3366     TCLY  CA 3  VR 1  MT 1  MI 1
95P3369     TCLY  MT 2  MI 2  KK 1  CA 1
_____________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    CA  calcite          VR  vermiculite      MT  montmorillon     MI  mica             KK  kaolinite

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks
```

```
                 Soil series: Hueco. Classification: Coarse-loamy, mixed, superactive, thermic Argic Petrocalcid.

                                  ***P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A***

S95NM-013-004A                                                                                            PRINT DATE 03/11/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 344, SAMPLE 97P 2088-2098

            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
_____________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - -><  - - - THERMAL - - - -><  - - - - - - - ELEMENTAL - - - - - - - -><  - -> EGME  INTER
SAMPLE       ION <                            >< - DTA - -><  - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <    > RETN  PRETA
                 < - - - - - -  7A2i - - - - - -><  - 7A6b - ><  - 7A4c - ><  - - - - - - - - - - 7C4a- - - - - - - - -><    >  7D2   TION
NUMBER     <- - ><  - - - - peak size - - - - -><  - - - Percent - - - -><  - - - - - - - - - Percent - - - - - - - -><  - -><mg/g><  - ->

97P2088     TCLY  CA 2  MT 1  QZ 1  KK 1
97P2089     TCLY  CA 2  QZ 1
97P2090     TCLY  CA 2  MT 1  QZ 1
97P2093     TCLY  CA 3  QZ 1
97P2096     TCLY  CA 2
97P2098     TCLY  CA 2
_____________________________________________________________________________________________________________________________________

FRACTION INTERPRETATION:

    TCLY  Total Clay, <0.002mm

MINERAL INTERPRETATION:

    CA  calcite          MT  montmorillon     QZ  quartz           KK  kaolinite

RELATIVE PEAK SIZE:   5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks
```

Soil series: Tres Hermanos, overwash phase
Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S96NM-013-001
Location: SW1/4NW1/4NW1/4 sec. 16, T. 21 S., R. 2 E., about 60 m east of the exclosure and 15 m north of road
Elevation: 4,360 feet, 1,329 m
Landform: Fan piedmont sloping 2 percent to the east
Geomorphic surface: Organ
Parent material: Fan piedmont alluvium derived from andesite, rhyolite, and monzonite. Sediments from 0 to 35 cm are Organ; from 35 to 58 cm, Isaacks' Ranch; from 58 to 207 cm, Jornada II; and from 207 to 240 cm, Jornada I.
Vegetation: Creosotebush, tarbush
Described and sampled by: L.H. Gile
Date: September. 27, 1996

A—0 to 5 cm; light reddish brown (6YR 6/3) gravelly sandy loam, reddish brown (6YR 4.5/3) moist; massive and single grain; soft, loose, very friable; few fine and very fine roots; slightly effervescent;

Soil series: Tres Hermanos, overwash phase. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

SSL - PROJECT 97P 18, (RP97NM023) DONA ANA
- PEDON 97P 88, SAMPLES 97P 549-562
- GENERAL METHODS 1B1A, 2A1, 2B

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
SAMPLE NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002 -.05	SAND .05 -2	FINE LT .0002	CO3 LT .002	FINE .002 -.02	COARSE .02 -.05	VF .05 -.10	F .10 -.25	M .25 -.50	C .5 -1	VC 1 -2	- - - - WEIGHT 2 -5	5 -20	20 -75	.1- 75	WT PCT OF WHOLE SOIL
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
97P 549S	0- 5	A	7.2	15.8	77.0			4.5	11.3	24.4	23.5	10.8	9.6	8.7	10	8	1	62	19
97P 550S	5- 22	Bk1	12.1	22.2	65.7			7.6	14.6	23.2	19.9	7.1	7.6	7.9	10	10	1	55	21
97P 551S	22- 35	Bk2	13.2	17.6	69.2			6.2	11.4	19.7	20.8	7.7	7.0	14.0	10	50	9	84	69
97P 552S	35- 58	Bkb	16.1	20.5	63.4			8.4	12.1	20.8	19.0	7.0	7.8	8.8	16	17	2	63	35
97P 553S	58- 75	BAtkb2	21.2	21.4	57.4		1.8	9.5	11.9	17.6	14.1	5.4	7.4	12.9	19	16	1	61	36
97P 554S	75- 92	Btkb2	24.7	22.2	53.1		3.2	11.4	10.8	19.9	14.1	5.8	6.8	6.5	12	13	4	53	29
97P 555S	92-110	K21b2	31.8	32.5	35.7		17.8	25.1	7.4	10.6	8.6	3.6	4.6	8.3	15	22	3	55	40
97P 556S	110-134	K22b2	28.4	30.5	41.1		17.6	21.7	8.8	10.3	8.3	3.6	5.7	13.2	18	34	6	71	58
97P 557S	134-157	K23b2	21.6	24.6	53.8		10.0	15.2	9.4	12.4	11.8	5.4	7.8	16.4	15	42	15	84	72
97P 558S	157-176	K3b2	18.7	21.5	59.8		8.9	13.6	7.9	12.2	14.0	8.5	10.6	14.5	15	45	11	85	71
97P 559S	176-191	Ck1b2	14.9	20.3	64.8		2.1	9.5	10.8	17.7	17.1	8.4	9.7	11.9	14	18	3	66	35
97P 560S	191-207	Ck2b2	15.1	17.9	67.0		1.5	8.1	9.8	17.1	17.1	9.4	10.2	13.2	15	16	2	66	33

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c <- PERCENT	(- - DITH-CIT - -) EXTRACTABLE FE 6C2b OF	AL 6G7a <2MM	MN 6D2a ->	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1 PCT	PI 4F <0.4MM	(- BULK DENSITY -) FIELD MOIST 4A5 <- - G/CC	1/3 BAR 4A1d - -	OVEN DRY 4A1h ->	COLE WHOLE SOIL 4D1 CM/CM	(- - -WATER CONTENT - -) FIELD MOIST 4B4 <- -	1/10 BAR 4B1c -PCT OF	1/3 BAR 4B1c <2MM	15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
0- 5	0.26							1.18	0.64										4.6	
5- 22	0.37							0.80	0.54										6.5	
22- 35	0.39							0.70	0.49										6.5	
35- 58	0.34							0.70	0.47										7.6	
58- 75	0.23							0.61	0.42										8.8	
75- 92	0.24							0.58	0.42										10.3	
92-110	0.23							0.35	0.29										9.1	
110-134	0.18							0.35	0.29										8.1	
134-157	0.12							0.46	0.35										7.6	
157-176	0.10							0.43	0.39										7.2	
176-191	0.06							0.68	0.46										6.8	
191-207	0.08							0.70	0.50										7.6	

AVERAGES, DEPTH 5- 55: PCT CLAY 14 PCT .1-75MM 65

Soil series: Tres Hermanos, overwash phase. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 88, SAMPLE 97P 549-562

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5	9.2	1.2	0.1	0.6	11.1	--		11.1	8.5	1		100	100	TR					7.5	8.2
5- 22		1.6	0.1	0.6					9.7	1		100	100	5					7.7	8.4
22- 35		2.1	0.1	0.5					9.2	1		100	100	7					7.7	8.3
35- 58		3.1	0.2	0.5					11.3	2		100	100	5					7.7	8.4
58- 75		3.9	0.4	0.7					12.9	3		100	100	5					7.8	8.6
75- 92		4.5	0.7	0.7					14.4	5		100	100	7					7.8	8.4
92-110		4.3	0.9	0.5					11.2	6	3	100	100	46				7.8	7.7	8.3
110-134		4.4	1.3	0.4					9.9	8	3	100	100	41		--		7.6	7.7	7.9
134-157		5.2	1.6	0.3					9.9	11	4	100	100	28		1		7.8	7.7	7.8
157-176		5.2	1.1	0.3					8.0	6	4	100	100	26		1		7.7	7.8	7.9
176-191		5.9	1.3	0.4					10.1	6	4	100	100	4		--		7.6	7.8	8.0
191-207		6.7	1.4	0.4					10.6	7	4	100	100	3		--		7.6	7.8	8.1

	(- - - - WATER EXTRACTED FROM SATURATED PASTE- - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - MEQ / LITER - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.15
5- 22																		0.15
22- 35																		0.19
35- 58																		0.17
58- 75																		0.19
75- 92																		0.22
92-110	4.0	1.4	5.4	0.2	--	2.5	0.2	0.9				7.4	--	0.2	41.0	TR	1.15	0.43
110-134	24.6	7.6	13.6	0.3	--	1.6	0.8	4.5				38.8	--	1.7	38.8	0.1	3.85	1.60
134-157	25.1	16.3	17.2	0.4	--	1.1	1.2	25.9				31.9	--	2.0	31.6	0.1	4.93	2.73
157-176	30.9	12.5	17.4	0.3	--	1.2	1.0	21.6				34.9	--	--	34.1	0.1	5.29	2.80
176-191	30.5	12.3	19.0	0.3	--	1.5	1.0	19.3				42.7	--	--	38.1	0.2	5.22	1.93
191-207	28.5	19.2	20.8	0.4	--	1.2	1.1	19.0				40.0	--	2.7	31.7	0.1	5.37	1.49

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Tres Hermanos, overwash phase. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S96NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

SSL - PROJECT 97P 18, (RP97NM023) DONA ANA
- PEDON 97P 88, SAMPLES 97P 549- 562
- GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	-1- DEPTH (CM)	-2- HORIZON	-3-	-4- (- - -TOTAL CLAY LT .002	-5- SILT .002 -.05	-6- SAND .05 -2 - - -)	-7- (- -CLAY- FINE LT .0002	-8- CO3 LT .002 -)	-9- (- -SILT- FINE .002 -.02	-10- COARSE .02 -.05 -)	-11- (- - - - VF .05 -.10	-12- F .10 -.25	-13- - -SAND- M .25 -.50	-14- C .5 -1	-15- VC 1 -2 - - - - -)	-16- (-COARSE FRACTIONS(MM)-) - - - - WEIGHT 2 -5	-17- 5 -20	-18- 20 -75	-19- - - - - .1- 75	-20- (>2MM) WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - - PCT OF <2MM (3A1)										- - - - - - - - - - - - - ->	<- PCT OF <75MM(3B1)->					
97P 561S	207-219	K1b3		33.9	19.0	47.1		10.5	11.8	7.2	13.8	15.5	6.1	6.7	5.0	12	24	--	57	36
97P 562S	219-240	K2b3		25.3	24.1	50.6		13.5	14.8	9.3	17.1	15.0	5.8	5.5	7.2	21	21	3	63	45

DEPTH (CM)	ORGN C 6A1c PCT	TOTAL N 6B4a <2MM	EXTR P 6S3b PPM	TOTAL S 6R3c <- PERCENT	(- - DITH-CIT EXTRACTABLE FE 6C2b OF	AL 6G7a	- -) MN 6D2a <2MM —>	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG) - LIMITS - LL 4F1 PCT <0.4MM	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A5 <- - G/CC	1/3 BAR 4A1d	OVEN DRY 4A1h - - ->	COLE WHOLE SOIL 4D1 CM/CM	(- - -WATER CONTENT FIELD MOIST 4B4 <- - -PCT OF <2MM	1/10 BAR 4B1c	1/3 BAR 4B1c	- -) 15 BAR 4B2a - ->	WRD WHOLE SOIL 4C1 CM/CM
207-219	0.09							0.48	0.34										11.6	
219-240	0.08							0.40	0.32										8.2	

AVERAGES, DEPTH 5- 55: PCT CLAY 23 PCT .1-75MM 57

Soil series: Tres Hermanos, overwash phase. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 88, SAMPLE 97P 549-562

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
207-219		11.3	2.1	0.6					16.1	8	6	100	100	21		--		7.8	7.9	8.2
219-240		7.2	1.4	0.4					10.0	8	6	100	100	33		--		7.9	7.9	8.3

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
207-219	10.3	9.6	17.9	0.3	--	1.1	0.8	20.9				15.7	--	1.7	44.1	0.1	3.86	1.19
219-240	6.9	7.5	14.9	0.3	--	1.2	0.5	16.5				11.3	--	1.4	37.8	0.1	3.10	0.75

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Dona Ana
Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S96NM-013-002
Location: SW1/4SW1/4NW1/4 sec. 15, T. 21 S., R. 2 E., 60 m south of Stuart Well Road
Elevation: 4,310 feet, 1,314 m
Landform: Fan piedmont sloping 1 percent to the east
Geomorphic surface: Jornada II
Parent material: Fan piedmont alluvium derived from

Btkb—207 to 225 cm; reddish brown (4YR 5/4) clay, reddish brown (4YR 4/4) moist; weak medium subangular blocky structure; very hard, friable; very few very fine roots; common carbonate filaments and few carbonate nodules; sand grains coated with oriented clay; slightly and strongly effervescent, few parts noncalcareous; clear wavy boundary.

K1b—225 to 240 cm; pinkish white (7.5YR 9/3) clay, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; hard and very hard, very friable; lesser volumes of 4YR 5/4, 4/4 moist; very few very fine roots; strongly effervescent; clear wavy boundary.

K2b—240 to 260 cm; pink (7.5YR 9/4) clay, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; very hard, very friable; very few very fine roots; strongly effervescent.

Soil series: Dona Ana. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-002 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 97P 18, (RP97NM023) DONA ANA
- PEDON 97P 89, SAMPLES 97P 563-579
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -)	(-COARSE FRACTIONS(MM)-)				(>2MM)	
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - -	- - - - -	- - - - -	- - - - -	PCT OF <2MM	(3A1)	- - - - -	- - - - -	- - - - -	- - - - -	- ->	<- PCT OF	<75MM(3B1)		->	SOIL
97P 563S	0- 5	A	13.0	21.1	65.9		1.0	9.2	11.9	21.4	27.6	11.5	4.3	1.1	1	TR	--	45	1
97P 564S	5- 12	BA	13.1	28.9	58.0		1.0	13.1	15.8	26.7	25.4	4.8	1.0	0.1	TR	--	--	31	TR
97P 565S	12- 20	Bt1	20.2	19.9	59.9		1.3	13.7	6.2	13.5	22.8	13.0	7.8	2.8	4	1	--	49	5
97P 566S	20- 35	Bt2	29.3	17.8	52.9		1.5	11.9	5.9	12.9	20.1	8.6	6.8	4.5	8	2	--	46	10
97P 567S	35- 47	Bt3	29.2	21.8	49.0		2.4	15.0	6.8	12.7	19.8	7.2	5.7	3.6	13	2	--	46	15
97P 568S	47- 62	Btk1	32.9	24.2	42.9		2.4	16.5	7.7	13.0	16.5	5.7	4.2	3.5	4	1	--	33	5
97P 569S	62- 74	Btk2	36.4	25.8	37.8		3.2	17.1	8.7	14.6	13.3	4.6	3.6	1.7	2	TR	--	25	2
97P 570S	74- 90	K2	40.7	31.9	27.4		17.1	20.9	11.0	13.5	9.9	2.4	1.2	0.4	8	TR	--	21	8
97P 571S	90-105	K3	27.9	33.6	38.5		13.7	20.2	13.4	18.6	14.4	3.2	1.4	0.9	10	TR	--	28	10
97P 572S	105-130	Bk1	18.9	28.5	52.6		6.4	14.1	14.4	27.5	20.2	3.2	1.2	0.5	16	2	--	39	18
97P 573S	130-157	Bk2	18.5	28.1	53.4		5.3	14.2	13.9	28.0	19.1	3.6	1.6	1.1	1	TR	--	26	1
97P 574S	157-178	Bk3	15.4	28.0	56.6		4.0	12.4	15.6	28.0	21.7	3.8	1.9	1.2	6	TR	--	33	6

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT	- -)			WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM	->			PCT <0.4MM		<- - G/CC	- -	->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
0- 5	0.85							1.08	0.56										7.3	
5- 12	0.81							1.23	0.62										8.1	
12- 20	0.42							0.89	0.46										9.3	
20- 35	0.43							0.71	0.38										11.1	
35- 47	0.37							0.69	0.40										11.7	
47- 62	0.30							0.62	0.37										12.3	
62- 74	0.24							0.57	0.37										13.3	
74- 90	0.28							0.34	0.28										11.5	
90-105	0.13							0.41	0.31										8.6	
105-130	0.08							0.56	0.40										7.6	
130-157	0.07							0.57	0.43										7.9	
157-178	0.05							0.68	0.48										7.4	

AVERAGES, DEPTH 12- 62: PCT CLAY 27 PCT .1-75MM 42

Soil series: Dona Ana. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S96NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 89, SAMPLE 97P 563-579

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5		1.9	0.2	1.1					14.1	2		100	100	2					7.6	8.4
5- 12		2.5	0.3	1.4					16.1	2		100	100	2					7.7	8.3
12- 20		2.6	0.4	1.4					17.9	2	1	100	100	1				7.7	7.7	8.2
20- 35		2.7	0.8	1.1					20.7	3	TR	100	100	2				7.6	7.6	8.0
35- 47		2.9	0.4	1.1					20.2	2		100	100	4					7.6	8.1
47- 62		3.2	0.5	1.0					20.5	2	1	100	100	4				7.6	7.6	8.1
62- 74		3.8	0.5	1.0					20.6	3		100	100	5					7.7	8.2
74- 90		3.6	--	0.6					13.9	TR		100	100	38					7.6	8.2
90-105		3.5	TR	0.5					11.5	TR		100	100	32					7.7	8.2
105-130		3.6	--	0.5					10.5	TR		100	100	20					7.7	8.4
130-157		4.1	--	0.6					10.6	TR		100	100	16					7.7	8.5
157-178		4.1	--	0.5					10.4	TR		100	100	13					7.8	8.4

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER - - - - - - - - - - - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.21
5- 12																		0.18
12- 20	6.8	1.1	1.0	0.5	--	4.8	--	3.1				2.3	--	0.1	28.5	TR	0.95	0.26
20- 35	9.1	1.4	0.9	0.3	--	3.4	0.1	3.1				4.8	--	0.1	37.6	TR	1.07	0.29
35- 47																		0.18
47- 62	6.3	1.2	1.1	0.2	--	2.7	0.1	2.7				4.0	TR	0.1	39.0	TR	0.84	0.26
62- 74																		0.22
74- 90																		0.23
90-105																		0.16
105-130																		0.15
130-157																		0.15
157-178																		0.13

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 5, 7, 8, 9, 10, 11, 12

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Dona Ana. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-002 PRINT DATE 03/04/02

SSL - PROJECT 97P 18, (RP97NM023) DONA ANA
- PEDON 97P 89, SAMPLES 97P 563-579
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL

Soil series: Dona Ana. Classification: Fine-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S96NM-013-002 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 89, SAMPLE 97P 563-579

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
178-194		4.7	--	0.6					11.0	TR		100	100	14					7.8	8.4
194-207		6.4	--	0.8					14.2	TR		100	100	17					7.8	8.6
207-225		11.9	TR	1.5					26.1	TR		100	100	8					7.8	8.3
225-240		7.8	--	0.9					15.1	TR		100	100	38					7.8	8.4
240-260		6.2	--	0.6					10.5	TR		100	100	61					7.8	8.5

ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Delnorte
Classification: Loamy-skeletal, mixed, superactive, thermic Typic Petrocalcid
Soil survey number: S96NM-013-003
Location: NE1/4NE1/4NE1/4NE1/4 sec. 20, T. 21 S., R. 2 E., 6 m south of road
Elevation: 4,400 feet, 1,341 m
Landform: Alluvial fan sloping 5 percent to the east
Geomorphic surface: Jornada II
Parent material: Fan alluvium derived from andesite and monzonite
Vegetation: Creosotebush, tarbush
Described and sampled by: L.H. Gile
Date: November 9, 1996

A—0 to 5 cm; pinkish gray (7.5YR 6/3) gravelly sandy loam, brown to dark brown (7.5YR 4/4) moist; weak medium and thick platy structure; soft, very friable; strongly effervescent; abrupt smooth boundary.
Bk—5 to 15 cm; pinkish gray (7.5YR 6/3) very gravelly sandy loam, brown to dark brown (7.5YR 4/4) moist; massive; soft, very friable; few fine and very fine roots; thin carbonate coatings on pebbles; strongly effervescent; clear wavy boundary.
K1—15 to 30 cm; pinkish gray (7.5YR 6/3) very gravelly sandy loam, brown to dark brown (7.5YR 4/3) moist; massive; soft, very friable; few fine and very fine roots; common calcrete fragments, mostly 1 to 3 cm in diameter but a few ranging up to 10 cm in diameter; carbonate coatings on pebbles; strongly effervescent; abrupt smooth boundary.
K21m—30 to 34 cm; consists of two parts, the upper part being a laminar horizon ranging from about 1/2 to 2 cm in thickness, cemented to an underlying plugged horizon; dominantly white (7.5YR 9/2) carbonate-cemented material, pinkish gray (7.5YR 7/2) moist; massive; extremely hard; a small amount slightly darker; strongly effervescent; abrupt smooth boundary.
K22m—34 to 50 cm; white (7.5YR 9/2) carbonate-cemented material, pinkish gray (7.5YR 7/2) moist; massive; extremely hard; strongly effervescent; clear wavy boundary.
K23m—50 to 63 cm; white (7.5YR 9/2) carbonate-cemented material, pinkish gray (7.5YR 9/2) moist; massive; extremely hard; strongly effervescent; clear wavy boundary.
K31—63 to 79 cm; pinkish white (7.5YR 8/2) very gravelly loamy sand, pinkish gray (7.5YR 7/2) moist; massive; hard and very hard, very friable; few fine and very fine roots; carbonate coatings on pebbles and sand grains; strongly effervescent; clear wavy boundary.
K32—79 to 96 cm; pinkish white (7.5YR. 8/2) very gravelly loamy sand, pinkish gray (7.5YR 7/2) moist; massive, hard, very friable; few fine and very fine roots; carbonate coatings on pebbles and sand grains; strongly effervescent; clear wavy boundary.
K33—96 to 120 cm; pinkish white (7.5YR 8/2) very gravelly sand, pinkish gray (7.5YR 7/3) moist; massive; slightly hard and soft, very friable; few fine and very fine roots; carbonate coatings on pebbles and sand grains; strongly effervescent.

Soil series: Delnorte. Classification: Loamy-skeletal, mixed, superactive, thermic Typic Petrocalcid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S96NM-013-003 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 97P 18, (RP97NM023) DONA ANA
- PEDON 97P 90, SAMPLES 97P 580-588
- GENERAL METHODS 1B1A, 2A1, 2B

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL	- - -)		(- -CLAY- -)		(- -SILT- -)		(- - - -	- -SAND- -		- - - -)		(-COARSE FRACTIONS(MM)-)				(>2MM)
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON		LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
				<- - - - - -	- - - - - - -			PCT OF <2MM	(3A1)	- - - - -	- - - - -	- - - ->		<- PCT OF	<75MM(3B1)	->		SOIL
97P 580S	0- 5	A		8.2	26.5	65.3		1.3	8.0	18.5	22.7	25.4	7.8	5.2	4.2	6	17	5	59	28
97P 581S	5- 15	Bk		14.5	28.2	57.3		2.9	12.1	16.1	18.7	16.6	7.3	6.6	8.1	8	22	43	83	73
97P 582S	15- 30	K1		16.9	29.8	53.3		7.6	12.6	17.2	16.0	15.2	6.0	6.5	9.6	6	20	53	87	79
97P 583S	30- 34	K21m		10.7	17.8	71.5		7.2	10.1	7.7	7.0	9.5	11.3	17.5	26.2	7	24	58	96	89
97P 584S	34- 50	K22m		11.9	22.0	66.1		8.3	12.6	9.4	9.6	12.0	10.2	14.2	20.1	10	33	42	93	85
97P 585S	50- 63	K23m		15.4	28.1	56.5		9.9	17.4	10.7	9.8	9.2	7.2	10.1	20.2	8	20	53	90	81
97P 586S	63- 79	K31		11.8	26.4	61.8		5.6	15.5	10.9	11.3	11.5	9.0	11.4	18.6	13	29	34	88	76
97P 587S	79- 96	K32		13.5	29.5	57.0		7.0	18.4	11.1	11.0	11.4	8.7	10.4	15.5	11	36	27	86	74
97P 588S	96-120	K33		13.3	26.3	60.4		5.6	16.9	9.4	9.2	11.4	8.7	11.2	19.9	8	28	44	90	80

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK DENSITY	-)		COLE	(- - -WATER	CONTENT	- -)		WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2b	6G7a	6D2a	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF	<2MM	- ->		CM/CM
0- 5	0.40							1.40	0.83										6.8	
5- 15	0.62							0.99	0.61										8.9	
15- 30	0.79							0.84	0.57										9.7	
30- 34	0.30							0.56	0.84										9.0	
34- 50	0.24							0.52	0.79										9.4	
50- 63	0.24							0.48	0.57										8.7	
63- 79	0.16							0.64	0.72										8.5	
79- 96	0.15							0.53	0.65										8.8	
96-120	0.11							0.49	0.59										7.8	

AVERAGES, DEPTH 0- 30: PCT CLAY 10 PCT .1-75MM 81

Soil series: Delnorte. Classification: Loamy-skeletal, mixed, superactive, thermic Typic Petrocalcid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S96NM-013-003 PRINT DATE 03/04/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 97P 90, SAMPLE 97P 580-588

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2e	6O2d	6P2b	6Q2b		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1g	6E4	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
0- 5		1.5	--	1.0					11.5	TR		100	100	5					7.8	8.5
5- 15		1.4	--	0.6					14.3	TR		100	100	14					7.7	8.4
15- 30		1.5	--	0.4					14.2	TR	1	100	100	20				7.6	7.6	8.3
30- 34		0.9	--	0.2					6.0	TR	1	100	100	58				7.7	7.6	8.2
34- 50		0.9	--	0.2					6.2	TR		100	100	57					7.6	8.2
50- 63		1.6	0.1	0.2					7.4	2	2	100	100	47				7.6	7.7	8.2
63- 79		2.1	0.6	0.2					7.5	5	5	100	100	28				7.9	7.7	8.6
79- 96		2.4	1.3	0.1					7.1	10	9	100	100	27		--		7.9	7.8	8.4
96-120		3.2	2.5	0.2					6.5	15	9	100	100	33		--		7.6	7.9	7.9

	(- - - WATER EXTRACTED FROM SATURATED PASTE- - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1b	6O1b	6P1b	6Q1b	6I1b	6J1b	6U1b	6K1d	6S9a	6X1a	6Y1a	6L1d	6W1b	6M1d	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - MEQ / LITER - - - - - - - - ->														<- -PCT- ->		/cm	/cm
0- 5																		0.17
5- 15																		0.22
15- 30	4.9	0.6	1.3	0.1	--	4.6	0.3	1.2				0.6	--	0.1	39.8	TR	0.66	0.25
30- 34	4.0	0.5	1.4	0.1	--	2.0	0.2	0.9				2.5	0.2	0.5	43.1	TR	0.62	0.26
34- 50																		0.23
50- 63	4.6	0.9	2.7	0.1	--	2.8	0.1	0.7				4.5	--	0.2	46.7	TR	0.83	0.30
63- 79	1.9	0.5	5.1	0.1	--	3.4	0.3	1.6				2.8	--	0.2	40.7	TR	0.78	0.27
79- 96	3.3	0.9	12.7	0.1	--	3.2	0.4	5.7				7.0	--	0.7	42.6	TR	1.71	0.52
96-120	26.2	7.8	36.0	0.2	--	1.2	1.1	24.9				48.7	--	--	42.4	0.2	6.09	2.66

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 5
ANALYSES: S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, deep analog
Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid
Soil survey number: S99NM-013-001
Location: SW¼NE¼SW¼ sec. 9, T. 20 S., R. 2 E., 10 m south of road
Elevation: 4,330 feet, 1,320 m
Landform: Level crest of a broad ridge
Geomorphic surface: Jornada II (eolian analog)
Parent material: Sandy eolian material of Jornada II age (upper horizons) and upper Camp Rice Formation (fluvial facies) sand (lower horizons)
Vegetation: Black grama, dropseed, Lehmann lovegrass, soaptree yucca
Described and sampled by: L.H. Gile
Date: November 11, 1998

C—0 to 17 cm; yellowish red (5YR 5/5) fine sand, yellowish red (5YR 3.5/5) moist; massive; weak medium platy structure; soft and slightly hard, very friable; common fine and very fine roots beneath grass clumps; few fine and very fine roots between clumps; slightly effervescent; abrupt smooth boundary.

Ab—17 to 22 cm; reddish brown (5YR 5/4) loamy sand, dark reddish brown (5YR 3.5/4) moist; massive; slightly hard, very friable; few fine and very fine roots; few insect tunnels, 1 to 3 mm in diameter; slightly effervescent; clear smooth boundary.

Btb—22 to 37 cm; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3.5/4) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; slightly hard and hard, very friable; few fine and very fine roots; sand grains coated with oriented clay; few insect tunnels, 1 to 10 mm in diameter; noncalcareous and slightly effervescent; clear wavy boundary.

Btk1b—37 to 51 cm; reddish brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3.5/4) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; few fine and very fine roots; sand grains coated with oriented clay; few carbonate filaments; slightly and strongly effervescent; clear wavy boundary.

Btk2b—51 to 70 cm; yellowish red (5YR 5/5) fine sandy loam, yellowish red (5YR 3.5/5) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; few fine and very fine roots; few carbonate filaments; sand grains coated with oriented clay; few insect tunnels, 1 to 10 mm in diameter; slightly effervescent; clear wavy boundary.

Btk3b—70 to 88 cm; yellowish red (5YR 5/5) fine sandy loam, yellowish red (5YR 3.5/5) moist; weak very coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; very few fine roots; few carbonate filaments; sand grains coated with oriented clay; few insect tunnels, 1 to 10 mm in diameter; slightly and strongly effervescent; clear wavy boundary.

K1b—88 to 101 cm; equal parts of pink (7.5YR 7/4) and pinkish white (7.5YR 9/2) sandy loam, brown (7.5YR 5/4) and pinkish gray (7.5YR 8/3) moist; weak medium subangular blocky structure; hard and very hard, friable; very few fine roots; few parts of 5YR 5/4 Bt material; strongly effervescent; clear wavy boundary.

K21b—101 to 115 cm; pinkish white (7.5YR 8/2) sandy clay loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium subangular blocky structure; very hard, firm and friable; few parts pinkish white (7.5YR 9/2); strongly effervescent; clear wavy boundary.

K22b—115 to 138 cm; pinkish white (7.5YR 8/2) sandy clay loam, pinkish gray to light brown (7.5YR 6.5/3) moist; weak medium subangular blocky structure; hard and very hard, friable; strongly effervescent; clear wavy boundary.

K23b—138 to 162 cm; pinkish white (7.5YR 8/2) sandy clay loam, pinkish gray to pink (7.5YR 7/3) moist; weak medium subangular blocky structure; hard and very hard, friable and firm; strongly effervescent; clear wavy boundary.

K24b—162 to 178 cm; pinkish white (7.5YR 8/3) sandy clay loam, pinkish gray to light brown (7.5YR 6.5/3) moist; a lesser amount pinkish white (7.5YR 9/2); weak medium subangular blocky structure; hard and very hard, friable and firm; strongly effervescent; clear wavy boundary.

K25b—178 to 216 cm; pinkish white (7.5YR 8/3) sandy clay loam, pinkish gray to light brown (7.5YR 6.5/3) moist; weak medium subangular blocky structure; very hard, friable and firm; strongly effervescent; clear wavy boundary.

K/Btb2—216 to 228 cm; pinkish white (7.5YR 8/3) fine sandy loam, pinkish gray to pink (7.5YR 7/3) moist; a lesser amount light reddish brown (5YR 6/4); weak medium subangular blocky structure; hard and very hard, friable and firm; reddish brown parts of Bt material, noncalcareous or weakly effervescent, occurring on insides of some carbonate-coated peds; strongly effervescent, noncalcareous, slightly effervescent; clear wavy boundary.

Kb2—228 to 251 cm; white (9YR 9/1) sandy loam, light gray (9YR 7/3) moist; weak medium subangular blocky structure; hard and very hard, friable; strongly effervescent; clear wavy boundary.

Ck1b2—251 to 281 cm; pinkish gray to pink (7.5YR 7/3) loamy sand, brown (7.5YR 5.5/4) moist; massive and single grain; soft and slightly hard, very friable; few hard and very hard carbonate masses; strongly effervescent; clear wavy boundary.

Ck2b2—281 to 306 cm; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; massive and single grain; soft and loose, very friable; very few hard carbonate masses, 1/2 to 5 cm in diameter; very few fine rounded pebbles; mostly noncalcareous; clear wavy boundary.

Ck3b2—306 to 324 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; a lesser amount white (10YR 8/2); weak medium subangular blocky structure; massive and single grain; soft, hard, and very hard, very friable and friable; few weakly cemented carbonate masses, 1/2 to 10 cm in diameter; few vertical calcareous root channel fillings, 1 to 4 mm in diameter; areas between are generally noncalcareous or slightly effervescent; clear wavy boundary.

Ck4b2—324 to 374 cm; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; massive and single grain; soft and loose, very friable; few vertical calcareous root channel fillings, 1 to 4 mm in diameter; areas between are generally noncalcareous or slightly effervescent; clear wavy boundary.

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S99NM-013-001 (DONA ANA COUNTY, NEW MEXICO) PRINT DATE 03/04/02

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL SOIL SURVEY CENTER
SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 225, SAMPLES 99P 1163-1181
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL	- - -)		(- -CLAY-	-)	(- -SILT-	-)	(- - - -	- -SAND-	-	- - - -	-)	(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - -	- WEIGHT	- - - -		WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - -	- - - - - - -	PCT OF <2MM	(3A1)	- - - - -	- - - - - -	- - ->			<- PCT OF	<75MM(3B1)->				SOIL
99P1163S	0- 17	C	6.3	4.6	89.1			1.4	3.2	10.7	53.4	23.7	1.2	0.1	--	--	--	78	--
99P1164S	17- 22	Ab	10.0	8.6	81.4			2.4	6.2	12.9	37.7	26.2	4.2	0.4	TR	--	--	68	TR
99P1165S	22- 37	Btb	12.8	7.3	79.9			2.0	5.3	9.3	32.6	30.7	6.4	0.9	1	TR	--	71	1
99P1166S	37- 51	Btk1b	16.6	9.9	73.5		1.8	3.6	6.3	9.3	27.6	28.3	7.3	1.0	1	TR	--	65	1
99P1167S	51- 70	Btk2b	15.7	10.6	73.7		1.8	5.4	5.2	9.6	30.5	28.0	4.4	1.2	1	TR	--	64	1
99P1168S	70- 88	Btk3b	15.0	10.1	74.9		2.1	4.1	6.0	10.0	30.5	26.6	6.0	1.8	1	1	--	66	2
99P1169N	88-101	K1b	16.5	12.7	70.8		6.4	7.2	5.5	9.9	29.0	24.3	5.8	1.8					
99P1170N	101-115	K21b	19.9	16.9	63.2		11.6	11.3	5.6	9.3	26.7	21.1	5.0	1.1					
99P1171N	115-138	K22b	23.5	16.9	59.6		12.7	12.3	4.6	7.5	26.9	20.3	4.2	0.7					
99P1172N	138-162	K23b	23.6	18.8	57.6		11.9	13.9	4.9	7.1	26.0	19.5	4.1	0.9					
99P1173N	162-178	K24b	22.5	17.5	60.0		10.5	13.6	3.9	6.8	25.5	21.2	5.2	1.3					
99P1174N	178-216	K25b	22.1	18.8	59.1		10.6	14.1	4.7	7.4	24.6	19.7	5.7	1.7					

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT	- -)		(RATIO/CLAY)		(ATTERBERG	)	(- BULK DENSITY	-)		COLE	(- - -WATER CONTENT	- -)			WRD
	C	N	P	S		EXTRACTABLE			15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2h	6G7g	6D2g	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM ->				PCT <0.4MM		<- - G/CC	- - ->		CM/CM	<- - -PCT OF	<2MM - ->			CM/CM
0- 17								0.92	0.44										2.8	
17- 22								0.84	0.41										4.1	
22- 37								0.73	0.41										5.2	
37- 51								0.57	0.38										6.3	
51- 70								0.64	0.43										6.7	
70- 88								0.61	0.45										6.8	
88-101								0.45	0.38										6.2	
101-115								0.31	0.36										7.2	
115-138								0.28	0.33										7.8	
138-162								0.18	0.36										8.5	
162-178								0.32	0.40										9.0	
178-216								0.33	0.40										8.8	

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S99NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 225, SAMPLE 99P 1163-1181

DEPTH (CM)	-1- CA 5B5a 6N2i	-2- MG 5B5a 6O2h	-3- NA 5B5a 6P2f	-4- K 5B5a 6Q2f	-5- SUM BASES	-6- ACID-ITY 6H5a	-7-	-8- CEC SUM CATS 5A3a	-9- CEC NH4-OAC 5A8b	-10- EXCH NA 5D2 PCT	-11- SAR 5E	-12- BASE SATURATION SUM 5C3	-13- BASE SATURATION NH4OAC 5C1	-14- CARBONATE AS CACO3 <2MM 6E1h	-15- CARBONATE AS CACO3 <20MM 6E4b	-16- CASO4 AS GYPSUM <2MM 6F1a	-17- CASO4 AS GYPSUM <20MM 6F4	-18- PH SAT PASTE 8C1b	-19- PH CACL2 .01M 8C1f 1:2	-20- PH H2O 8C1f 1:1
	(- NH4OAC EXTRACTABLE BASES -) <- - - - - - - - - - -MEQ / 100 G							(- -CEC- -)	- - - - - - - - - - ->			<- -PCT- >		<- -PCT ->		<- -PCT ->		(- - - -PH - - -)		
0- 17		0.8	0.2	0.2		--			5.8	4		100	100	1					7.9	8.6
17- 22	14.4	1.2	0.2	0.7	16.5	--		16.5	8.4	3		100	100	TR					7.8	8.5
22- 37	17.3	1.3	0.3	0.5	19.4	--		19.4	9.4	3		100	100	TR					7.8	8.3
37- 51		2.3	0.2	0.3					9.5	2		100	100	4					7.8	8.4
51- 70		3.2	0.2	0.1					10.1	2		100	100	4					7.8	8.4
70- 88		3.5	0.3	0.1					9.1	4		100	100	4					7.9	8.5
88-101		3.5	0.5	0.1					7.4	5	2	100	100	12				7.8	7.9	8.5
101-115		3.8	1.1	TR					6.1	10	5	100	100	24		--		7.8	8.0	8.4
115-138		5.2	2.0	0.1					6.6	14	8	100	100	24		--		7.9	8.1	8.5
138-162		3.7	1.5	--					4.2	2	9	100	100	25		--		8.0	8.1	8.3
162-178		6.0	2.8	0.1					7.2	15	8	100	100	23		--		7.9	8.1	8.3
178-216		6.1	2.9	0.1					7.4	14	8	100	100	28		--		7.9	8.1	8.2

(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)

DEPTH (CM)	CA 6N1d	MG 6O1d	NA 6P1d	K 6Q1d	CO3 6I1b	HCO3 6J1b	F 6U1c	CL 6K1e	PO4 6S9a	Br 6X1a	OAC 6Y1a	SO4 6L1e	NO2 6W1c	NO3 6M1e	H2O 8A	TOTAL SALTS EST. 8D5	ELEC. COND. 8A3a MMHOS /cm	PRED. ELEC. COND. 8I MMHOS /cm
	<- - - - - - - - - - - - - - - - - - MEQ / LITER													- - - - - - - - - - - - - - - - - - ->	<- -PCT-	->		
0- 17																		0.15
17- 22																		0.16
22- 37																		0.20
37- 51																		0.22
51- 70																		0.23
70- 88																		0.23
88-101	2.8	1.5	3.4	0.2	--	2.7	TR	2.7				1.1	0.8	0.1	34.1	TR	0.79	0.32
101-115	5.8	5.4	12.2	0.3	--	2.0	0.2	11.7				6.9	0.7	1.9	38.7	0.1	2.30	0.75
115-138	7.2	9.9	23.0	0.2	--	1.2	0.6	21.0				13.7	--	3.4	46.3	0.1	3.83	1.27
138-162	8.2	13.4	29.7	0.2	--	1.1	0.8	29.5				17.6	--	3.7	46.7	0.2	4.99	1.56
162-178	14.8	21.3	36.1	0.2	--	0.9	1.0	31.3				33.9	--	3.6	47.1	0.2	6.28	2.20
178-216	25.0	27.2	38.9	0.2	--	0.8	0.6	25.0				60.9	--	1.2	46.6	0.3	7.08	3.28

MMHOS/CM OF 1:2 WATER EXTRACT (8I) & EXCH NA AS EXTRACTABLE NA FOR LAYERS 1, 2, 3, 4, 5, 6

ANALYSES: S= ALL ON SIEVED <2mm BASIS N= >2mm FRACTIONS NOT DETERMINED

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y C H A R A C T E R I Z A T I O N D A T A

S99NM-013-001

PRINT DATE 03/04/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 225, SAMPLES 99P 1163-1181
- GENERAL METHODS 1B1A, 2A1, 2B

-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
			(- - -TOTAL - - -)			(- -CLAY- -)		(- -SILT- -)		(- - - - - -SAND- - - - - -)					(-COARSE FRACTIONS(MM)-)				(>2MM)
			CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT			- - - -	WT
SAMPLE	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
			<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				SOIL
99P1175N	216-228	K/Bt2	16.7	17.6	65.7		3.8	10.4	7.2	11.7	30.5	18.8	3.7	1.0					
99P1176N	228-251	Kb2	13.6	23.0	63.4		5.7	15.0	8.0	8.7	24.2	23.7	5.5	1.3					
99P1177S	251-281	Ck1b2	9.1	10.5	80.4		2.9	5.9	4.6	7.4	31.2	33.0	7.2	1.6	3	3	--	75	6
99P1178S	281-306	Ck2b2	2.5	3.9	93.6			1.7	2.2	3.8	29.5	46.8	11.5	2.0	2	2	--	90	4
99P1179S	306-324	Ck3b2	2.4	4.1	93.5		1.0	2.1	2.0	2.7	22.0	49.4	16.6	2.8	4	4	19	93	27
99P1180S	324-374	Ck4b2	1.8	1.1	97.1			0.8	0.3	1.8	23.3	56.0	14.5	1.5	1	1	--	95	2
99P1181S	374-399	Ck5b2	1.4	1.9	96.7			1.0	0.9	1.2	10.8	45.2	31.5	8.0	4	1	--	96	5

	ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)			(RATIO/CLAY)		(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - -)				WRD
	C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
DEPTH					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
(CM)	6A1c	6B4a	6S3b	6R3c	6C2h	6G7g	6D2g	8D1	8D1	4F1	4F	4A5	4A1d	4A1h	4D1	4B4	4B1c	4B1c	4B2a	4C1
	PCT	<2MM	PPM	<- PERCENT	OF	<2MM —>				PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
216-228								0.62	0.57										9.6	
228-251								0.57	0.63										8.6	
251-281								0.66	0.56										5.1	
281-306								1.80	0.96										2.4	
306-324								2.17	1.17										2.8	
324-374								2.33	1.06										1.9	
374-399								3.29	1.36										1.9	

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S99NM-013-001 PRINT DATE 03/04/02

USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 225, SAMPLE 99P 1163-1181

	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
	(- NH4OAC EXTRACTABLE BASES -)					ACID-		(- -CEC- -)		EXCH	SAR	BASE		CARBONATE		CASO4 AS		(- - - -PH - - -)		
	CA	MG	NA	K	SUM	ITY		SUM	NH4-	NA		SATURATION		AS CACO3		GYPSUM		SAT	CACL2	H2O
DEPTH	5B5a	5B5a	5B5a	5B5a	BASES			CATS	OAC			SUM	NH4OAC	<2MM	<20MM	<2MM	<20MM	PASTE	.01M	
(CM)	6N2i	6O2h	6P2f	6Q2f		6H5a		5A3a	5A8b	5D2	5E	5C3	5C1	6E1h	6E4b	6F1a	6F4	8C1b	8C1f	8C1f
	<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->									PCT		<- -PCT- >		<- -PCT ->		<- -PCT ->			1:2	1:1
216-228		8.3	3.4	0.1					10.4	16	8	100	100	15		1		7.8	8.0	8.0
228-251		6.9	2.9	0.1					7.7	19	8	100	100	21		1		7.8	8.0	8.0
251-281		4.7	2.1	--					6.0	19	8	100	100	7		--		7.8	8.1	8.2
281-306		2.7	1.4	--		--			4.5	22	11	100	100	1		--		8.3	8.3	9.0
306-324		3.0	1.6	TR					5.2	17	8	100	100	3		--		8.0	8.1	8.5
324-374	2.7	1.9	1.1	--	5.7	--		5.7	4.2	19	11	100	100	TR				8.3	8.2	8.9
374-399		2.1	1.2	0.1		--			4.6	17	9	100	100	1				8.2	8.1	8.7

	(- - - - - - - - - - - - - - - - WATER EXTRACTED FROM SATURATED PASTE- - - - - - - - - - - - - - - - -)																	PRED.
																TOTAL	ELEC.	ELEC.
	CA	MG	NA	K	CO3	HCO3	F	CL	PO4	Br	OAC	SO4	NO2	NO3	H2O	SALTS	COND.	COND.
DEPTH																EST.	8A3a	8I
(CM)	6N1d	6O1d	6P1d	6Q1d	6I1b	6J1b	6U1c	6K1e	6S9a	6X1a	6Y1a	6L1e	6W1c	6M1e	8A	8D5	MMHOS	MMHOS
	<- - - - - - - - - - - - - - - - - - MEQ / LITER ->														<- -PCT- ->		/cm	/cm
216-228	23.6	24.8	38.5	0.2	--	1.0	0.4	16.8				67.1	0.7	--	43.1	0.2	6.73	4.12
228-251	23.5	23.6	37.5	0.2	--	1.0	--	19.6				61.5	--	0.6	38.7	0.2	6.77	3.90
251-281	20.3	19.4	33.9	0.2	--	1.0	--	14.1				58.6	--	0.6	27.6	0.1	6.05	1.65
281-306	2.5	2.4	17.0	0.2	--	1.7	--	8.8				13.1	--	0.6	22.3	TR	2.39	0.54
306-324	13.3	13.1	30.7	0.2	--	1.3	0.2	11.4				42.5	--	0.7	24.4	0.1	4.90	1.10
324-374	1.6	1.6	13.6	0.1	--	1.6	TR	8.6				6.8	--	0.6	23.1	TR	1.75	0.37
374-399	3.7	2.9	16.7	0.1	--	1.5	0.2	9.8				10.6	--	0.7	24.2	TR	2.46	0.43

ANALYSES: N= >2mm FRACTIONS NOT DETERMINED   S= ALL ON SIEVED <2mm BASIS

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S99NM-013-001 PRINT DATE 03/13/02

SSL - PROJECT 99P 48, (CP99NM064) JORNADA EXP RANGE
- PEDON 99P 225, SAMPLES 99P 1163-1181
- GENERAL METHODS 1B1A, 2A1, 2B

		-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
		ACID	OXALATE	EXTRACTION		PHOSPHOUS		KCL	TOTAL	(- -WATER	CONTENT- -)			(- - - - WATER DISPERSIBLE - - - -)						MIN	AGGRT
		OPT	FE	SI	AL		CIT-	MN	C	0.06	1-	2-	15	<- - PIPETTE - - >			< - HYDROMETER - >			SOIL	STABL
		DEN				RET	ACID			BAR	BAR	BAR	BAR	CLAY	SILT	SAND	CLAY	SILT	SAND	CONT	<5mm
SAMPLE	HZ	8J1c	6C9b	6V2b	6G12b	6S4d	6S5	6D3b	6A2e	4B1c	4B1a	4B1a	4B2b	<- - -	3A1c	- - ->	<- - -	SML	- - ->	8F1	4G1
NO.	NO		<- P C T o f < 2 m m ->			<- P P M		->	< - - - -	- - - -	- - - P E R C E N T	o f	< 2 m m	- - -	- - -	- - -	- - -	>	<20mm>	< PCT>
99P1163	1								0.27												
99P1164	2								0.19												
99P1165	3								0.31												
99P1166	4								0.71												
99P1167	5								0.72												
99P1168	6								0.70												
99P1169	7								1.29												
99P1170	8								3.10												
99P1171	9								3.21												
99P1172	10								2.60												
99P1173	11								2.03												
99P1174	12								2.79												
99P1175	13								1.78												
99P1176	14								2.89												
99P1177	15								0.75												
99P1178	16								0.10												
99P1179	17								0.33												
99P1180	18								TR												
99P1181	19								0.09												

Soil series: Yucca, deep analog. Classification: Coarse-loamy, mixed, superactive, thermic Typic Calciargid.

P R I M A R Y   C H A R A C T E R I Z A T I O N   D A T A

S99NM-013-001 PRINT DATE 03/11/02
USDA-NRCS-NSSC-SOIL SURVEY LABORATORY; PEDON 99P 225, SAMPLE 99P 1163-1181

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            -1-   -2-   -3-   -4-   -5-   -6-   -7-   -8-   -9-   -10-  -11-  -12-  -13-  -14-  -15-  -16-  -17-  -18-  -19-  -20-
___________________________________________________________________________________________________________________________________

           < - - - - - - - - - - - - - - - - - - - - - - - -  CLAY MINERALOGY (<.002mm) - - - - - - - - - - - - - - - - - - - - - - - - >
           FRACT < - - - - - - X-RAY - - - - - ->< - - - THERMAL - - - ->< - - - - - - - - ELEMENTAL - - - - - - - -->< - -> EGME  INTER
SAMPLE       ION <                            >< - DTA - -->< - TGA - -> SiO2 AL2O3 Fe2O3  MgO   CaO   K2O   Na2O <     > RETN  PRETA
                 < - - - - - -  7A2i - - - - - ->< - 7A6b - >< - 7A4c - >< - - - - - - - - - - 7C4a- - - - - - - - - -><     >  7D2   TION
NUMBER     <- - >< - - - - peak size - - - - ->< - - - Percent - - - ->< - - - - - - - - - Percent - - - - - - - - ->< - -><mg/g>< - ->

99P1165      TCLY  MT 2  MI 2  KK 2  CA 1  QZ 1
99P1168      TCLY  MT 2  CA 2  MI 2  KK 2  QZ 1
___________________________________________________________________________________________________________________________________
```

FRACTION INTERPRETATION:

TCLY Total Clay, <0.002mm

MINERAL INTERPRETATION:

MT montmorillon   MI mica   KK kaolinite   CA calcite   QZ quartz

RELATIVE PEAK SIZE: 5 Very Large   4 Large   3 Medium   2 Small   1 Very Small   6 No Peaks

Chapter 2: Areal Evaluation of Organic and Carbonate Carbon [1]

Introduction

Chapter 2 is an update of a paper previously presented (Grossman et al., 1995). The geomorphic and pedogenic setting of the study area is given in chapter 1.

An understanding of global climate change requires estimates of terrestrial carbon, which includes organic and carbonate carbon. Globally, the two sources in soils are in the ratio of about 2:1 (Schlesinger, 1991; Houghton and Skole, 1990; Eswaran et al., 2000). More emphasis has been placed on organic than on carbonate carbon. In fact, global estimates of carbon storage in soils often do not include carbonate carbon accumulations in arid and semiarid environments (Schlesinger, 1990; Post et al., 1982; Schlesinger, 1977; Bohn, 1976). There is a wealth of data relating to organic matter, which is important for agriculture. A notable example of the application of the soil survey database is Parton et al. (1987). Compilations on a broad scale have been made using the soil survey database (Kimble et al., 1990; Bryant et al., 1991; Sanchez et al., 1982; Eswaran et al., 2000). These studies organize the data by taxa of the U.S. taxonomy

Table 1. —Specifications for the study

Project	
Total area	224,669 acres[1]
Measurement area (total minus rock land)	185,092 acres[2]
Mapping	
Scale	1:15,840
Number of map units	79
Number of map unit components	593
Laboratory sampling[3]	
Pedon	
Available	150
Employed	93
Number of pedon assignments	744
Areally weighted area per assigned pedon[4]	603 acres

[1] Some minor components were grouped and assigned an aggregate areal percentage, and the components were assumed to have the same composition.

[2] Information presented subsequently is for the measurement area. Streamwash was included as a map unit component.

[3] Data are drawn from Gile and Grossman (1979), Gile (1987), Gile (1994), Monger et al. (1991b), Tatarko (1980), and the Appendix of chapter 1. Most of the soils sampled are in the Desert Project, but a few are nearby, in the Jornada Experimental Range and in a study area along the Organ Mountains fault.

[4] The sum for all map units of the product of the average area per pedon and the areal fraction of the map unit.

map unit components were assigned several pedons, others only one pedon. The pedon assignments were made on the basis of detailed field experience gained not only over the course of the formal project but to the present time. Over 700 pedon assignments were made to map unit components. Assignments were made for all map unit components using whatever was considered the most applicable laboratory data at hand. This is an important point. There were no prior standards for applicability of the laboratory data. In some instances, data were assigned which were identified with a different soil series. The exercise has substance because the density of laboratory pedons to draw from is quite high and the area of the map unit components taken individually is relatively small.

For each assigned laboratory pedon, the kilograms of organic carbon and/or carbonate carbon (0.12 times the $CaC0_3$ equivalent percentage) per square meter to a variable depth was calculated. The organic carbon was determined by the Walkley-Black method, (6A1 in USDA, 1992). The carbon values are sums for the various layers (horizons) of the quantities obtained by the following relationship:

$$\frac{L \times p \times Xc \times (1 - Vr)}{10}$$

where L is the thickness in centimeters, p is the bulk density of the <2 mm fabric in Mg m^{-3}, Xc is the <2 mm carbon percentage, and Vr is the volume of rock fragments expressed in fractional form to facilitate calculation. For carbonate-cemented horizons developed in low-carbonate parent materials, the weight of >2 mm after removal of the carbonate was calculated to a carbonate-containing volume basis (Gile and Grossman, 1979). Organic carbon was summed to the depth measured, which generally was to where the values were below 0.1 percent. It was assumed that soils formed in low-carbonate materials had zero initial carbonate. Various assumptions were made about soils that formed in high-carbonate materials. Carbonate carbon was summed to the depth encompassed by the concept of the map unit component. Commonly, carbonate in buried soils was excluded unless it was part of the concept of the map unit component. This matter will be discussed later.

Table 2 gives, in a hierarchical fashion, carbon values for different composition-climate parts of the measurement area. These values were obtained by first computing areal weighted means for the map units from the carbon values and areal proportions of the components. Each map unit mean was then multiplied by its respective areal fraction of the composition-climate part to which it was assigned. The products were then summed.

Results

The measurement area contains 2.2 Tg (10^{12} g) of organic carbon (table 2). The low-carbonate area contains 15.1 Tg of carbonate carbon. The organic carbon mean for the whole measurement area is 2.9 kg m^{-2} with a higher value for the semiarid portion. Soils that contain $\geq$35 percent, by volume, rock fragments within depth limits that depend on the classification of the soil are referred to as skeletal. Skeletal map units have less organic carbon than nonskeletal units (2.4 versus 3.1 percent). The map units strongly influenced by high-carbonate materials that are nonskeletal have the highest organic carbon. The semiarid soils are 77 percent skeletal compared to 28 percent for the arid. The greater proportion of skeletal soils reduces the difference in organic carbon between the arid and semiarid parts. On a worldwide basis, the orographic increase in skeletal soils should act to reduce the increase in organic carbon expressed on an areal basis as elevation increases.

For the soils developed in high-carbonate parent materials, the carbonate values are misleading for the purposes here. The arid soils formed in low-carbonate materials contain 26.3 kg m^{-2} of carbonate carbon. This value is applicable to 74 percent of the measurement area. For arid soils formed in low-

Table 2.—Organic and carbonate carbon expressed areally for the measurement area with subdivisions on parent material and climate

Part of measurement area	Portion of measurement area	Carbon: Organic	Carbon: Carbonate
	%	kg m^{-2}	kg m^{-2}
Total area	100.0	2.9	28.5
Low-carbonate materials	79.8	2.6	25.3
High-carbonate materials	20.2	4.1	41.2
Arid part	93.4	2.9	29.6
Low-carbonate materials	73.9	2.5	26.3
Skeletal [1] [2]	17.8	2.1	18.3
Nonskeletal	56.1	2.6	28.8
<10% skeletal [2]	43.7	2.8	30.7
10-50% skeletal [2]	12.4	2.1	22.0
High-carbonate materials	19.5	4.2	42.0
Skeletal [1] [2]	8.2	2.9	39.6
Nonskeletal	11.3	5.1	43.7
<10% skeletal [2]	8.1	5.3	52.8
10-50% skeletal [2]	3.2	4.6	20.7
Semiarid part [3]	6.5	3.5	13.1
Low-carbonate materials	5.8	3.6	12.4
Skeletal [1] [2]	4.4	3.0	16.0
Nonskeletal [2]	1.4	5.6	0.9
High-carbonate materials	0.7	2.7	18.9
Skeletal [1] [2]	0.6	2.0	19.5
Nonskeletal [2]	0.1	6.7	15.2

[1] More than 50% of the map unit has ≥35%, by volume, rock fragments through a depth zone that may change, depending on the classification of the soil.
[2] Parts to which maps units were directly assigned; others are derivative.
[3] More than 1,500 m elevation.

carbonate parent materials, nonskeletal map units have substantially more carbonate carbon than do skeletal map units (28.8 vs. 18.3 kg m^{-2}). As a generality, carbonate carbon exceeds organic carbon about 10-fold.

Discussion

The major items of discussion are areal soil organic carbon, prediction of soil carbon, carbonate carbon that is not included in this study, the rate of carbonate accumulation, and carbonate as a CO_2 sink.

Areal Soil Organic Carbon

The weighted average organic carbon for the arid part of the study area of 2.9 kg m^{-2} is similar to the 3.3 kg m^{-2} for Desert Shrub given in Schlesinger (1991) and exceeds the value given by Post et al. (1982) of 1.2 kg m^{-2} for warm deserts. The areal weighted average organic carbon for a generally cultivated county in southwest Iowa is 12 kg m^{-2} (Grossman et al., 1992), about 4 times that for the measurement area of the project discussed here. Some pedons developed in fine-silty sediments high in carbonate in the project area reach about 10 kg m^{-2} organic carbon, approximately that for the average of the county in southwest Iowa. Wilding (personal communication, 2001) and colleagues have studied the microbiology of several of the fine-silty soils high in carbonate from the study area. Carbon dioxide evolution, dehydrogenese activity, and bacterial population were within usually expected ranges. Carbon dioxide evolution increased markedly with glucose amendment but did not on addition of a complete inorganic nutrient solution. Dehydrogenese activity did not increase with addition of glucose. Surface horizons had higher values for all three measurements than subsoil horizons and additionally had higher carbon extracted both by cold water and by autoclaving a soil suspension.

Prediction of Soil Carbon

Taxonomic placement (Soil Survey Staff, 1999) is quite predictive for organic carbon. Soils in the arid part that are high in rock fragments (skeletal) and have coarse or medium textures are low (<2 kg) in organic carbon. The presence of petrocalcic horizons within 50 cm of the ground surface coupled with the aforementioned coarse particle size leads to low organic carbon even in some instances if the soil is semiarid. High relative amounts of organic carbon (>6 kg) are the usual situation in semiarid areas with the exceptions previously given. As mentioned before, soils in fine-silty families that formed in high-carbonate material have relatively high organic carbon. Haplargids and Calciargids in fine families also generally have relatively high organic carbon. Some coarse soils on coppice dunes commonly have relatively high organic carbon, in part because of the strong biological activity.

Following is a summary of some relationships between organic carbon and soil taxa:

Low relative amounts - <2 kg m^{-2}

Amount predominant if:
- Typic and sandy, sandy-skeletal, or loamy-skeletal soils. (Two sandy-skeletal pedons have <1 kg.)
- Argic Petrocalcids with the previous particle sizes.

Amount common if:
- Typic or coarse-loamy.

High relative amounts - >6 kg m^{-2}

Amount predominant if:
- Ustic subgroups or Haplustolls, both irrespective of particle size.
- Fine-silty families with a calcic horizon or in a calcareous family (Ustic subgroup reaches 10 kg m^{-2}).

Amount common if:
- Fine Haplargids and Calciargids (Ustic subgroups reach 10 kg m^{-2}).
- Torripsamments formed by eolian accretion.

The reason for the increase in organic carbon as the particle size becomes finer may have several contributing explanations and ramifications. First, there is a tendency for soils with finer particle sizes to be in lower areas on the landscape where run-on provides more moisture for plants. Second, there is the possibility that grasses instead of shrubs are favored by a nonskeletal particle size (Hallmark and Allen, 1975). Third, the water retention of the finer particle-size materials should be higher, although there is the counter argument that precipitation moves deeper in the coarser textures and therefore can be used more effectively by plants. Fourth, there is the possibility, as has been discussed, that fine grained carbonate acts to enhance organic carbon accumulation. Fine-silty soils of the measurement area tend to be high in fine carbonate throughout the rooting depth and have the highest organic carbon in the study. Fifth, there is the common observation that organic carbon tends to increase with noncarbonate clay (Nichols, 1984; Parton et al., 1987). For the measurement area, the following relationship for argillic horizons was found: OC(kg m^{-2}) = 0.06 + 0.15 (clay %); $n = 28$, $r = 0.86$ (Gile and Grossman, 1979). Organic carbon was computed to the base of the horizon nearest to 1 m. The noncarbonate clay was calculated on a carbonate-containing weighted average basis for 0-50 cm. The content of rock fragments was less than 10 percent, by volume. The aforementioned tendency for the finer textured soils to occur in lower areas on the landscape where they are more commonly subject to run-on may be a confounding factor. Finally, as indicated, skeletal soils in the arid portion tend to have lower organic carbon. Soils that are skeletal tend to have less clay throughout the zone of highest organic-carbon accumulation. This tendency may be a contributing reason why the organic carbon is lower.

In soils that formed in low-carbonate materials, taxonomic placement is predictive of carbonate carbon. Argic and Typic Petrocalcids and Typic Petroargids range as high as near 200 kg m^{-2} of carbonate carbon, whereas Haplustolls and Torriorthents have <1 kg m^{-2}. Haplargids and Calciargids that have formed in low-carbonate materials have a wide range, 1 to 100 kg m^{-2}, depending on soil age, climate, and rock fragment volume. The huge range in carbonate for low-carbonate materials leads to map units of small relative area having a potentially appreciable influence on the carbonate content of the groupings in table 2.

Carbonate Carbon That Is Not Included

Very large amounts of carbonate carbon are not shown by our data. One kind is pedogenic, and the other is nonpedogenic.

Numerous buried soils occur in the Desert Project and in other arid and semiarid regions. Figure 57 in chapter 1 shows a long exposure of two buried soils beneath the soil at the land surface. In addition, more buried soils with carbonate horizons probably occur beneath those shown in figure 57. The buried soils are not included in the calculated carbonate carbon unless they are part of the soil concept. Hence, the amounts of carbonate carbon actually present may greatly exceed the amounts reported in this study.

Besides buried soil carbonate, two other kinds of carbonate are not considered. One kind is ground-water carbonate, and the other is parent-material carbonate. The former is emplaced from laterally moving ground water instead of from water descending from the soil surface. The amount of this carbonate has not been measured and is not considered, but observations of deep sections indicate that it is substantial.

Parent-material carbonate occurs mostly in two general areas—west of the San Andres Mountains and east of the Robledo Mountains (see color map 1). Large areas of igneous rocks occur along with the limestone and other carbonate-containing rocks in the San Andres Mountains. The alluvium downslope consequently consists of a mixture of substantial amounts of both igneous and carbonate-containing rocks. The content of carbonate in the parent materials commonly ranges from 15 to 50 percent. In contrast to the San Andres Mountains, the Robledo Mountains contain mostly limestone and other carbonate-containing rocks. Thus, the alluvium downslope from the Robledo Mountains contains much more parent-material carbonate. Analyses of mostly C horizon material for three pedons (table 3) suggest that the magnitude of carbonate carbon in the high-carbonate parent materials of these soils is well over 50 percent.

Table 3. —Carbonate data illustrating the very high amounts of >2 mm parent-material carbonate for three pedons east of the Robledo Mountains

Soil	Horizon	Depth	Carbonate	
			<2 mm	Whole material
		cm	*%*	*%*
Typic Torriorthent, Dalian 66-4	Arbitrary	0-79	30	61 [1]
Calcic Petrocalcid, Tencee 62-1	Ck	86-107	38	66
Calcic Petrocalcid, Upton 66-5	Ck	74-102	58	81

[1] 20-75 mm.

Strategies were employed to remove the >2 mm percent material carbon while keeping the authigenic carbonate. Parent material <2 mm could not be removed.

Rate of Carbonate Accumulation

Data from seven pedons in the aridic part of the measurement area were used in an evaluation of the accumulation rate of carbonate carbon in soils of late Holocene age (Gile and Grossman, 1979). These pedons developed in nominally noncalcareous parent materials and are in sandy, coarse-loamy, or fine-loamy families (Soil Survey Staff, 1999). An initial assumed carbonate carbon content of 1 percent for the <2 mm was subtracted. The range in the rate of accumulation is 0.1 to 1.4 g m^{-2} yr, which is below the 3 g m^{-2} yr given by Schlesinger (1991). The rates of accumulation for 24 pedons of late Pleistocene to early Pleistocene age are about the same as for the Holocene soils. The similarity suggests that net carbonate carbon accumulation over periods of time measured in tens of thousands of years in the Pleistocene (including pluvials) did not differ too much from that in the late Holocene. Machette (1985) estimated accumulation rates for the soils discussed here plus soils of the latest Pleistocene. He concluded that the rate of carbonate accumulation in the Holocene was roughly twice the rate of accumulation during pluvial episodes.

Carbonate as a CO_2 Sink

For authigenic carbonate carbon to be a sink for atmospheric $C0_2$, at least a portion of the calcium must not come from carbonate (Monger and Gallegos, 2000). If the authigenic soil carbonate originated through the dissolving of carbonate in dust deposited on the ground surface followed by precipitation of the carbonate within the soil, there would not be a net transfer of atmospheric CO_2 to the soil. Similarly, if the calcium in the authigenic carbonate came from calcium in the precipitation, to the extent that this calcium originated by dissolving carbonate dust, there would not be a net transfer of CO_2 to the soil. On the other hand, if the calcium originated by weathering of the host noncarbonate minerals in the soil or from noncalcareous atmospheric sources, then the authigenic carbonate would be a sink for atmospheric $C0_2$. It has been postulated that much of the calcium did originate from carbonate in dry dust or from calcium dissolved in the precipitation that came from carbonate dust (Gile and Grossman, 1979). Monger et al. (1991a and 1991b) and Monger and Gallegos

(2000) present evidence that micro-organisms are involved in the precipitation of carbonate. This involvement may be a further complication.

Isotopic composition of strontium (Sr), specifically $^{87}Sr/^{86}Sr$, is used to evaluate the source of calcium in carbonates (Elfessen et al., 2000; Graustein, 1989). Sr has a radius similar to that of Ca and is prone to substitute for Ca in crystalline structures. $^{87}Sr/^{86}Sr$ ratio is unique to geological environments and is not subject to change under physical or chemical process. Hence, it may be used to distinguish in situ weathering from atmospheric sources. $^{87}Sr/^{86}Sr$ studies have been made for sites in the project area. Based on $^{87}Sr/^{86}Sr$, Capo and Chadwick (1999) report that over 98 percent of the calcium for low-carbonate samples from the project area is derived from dust and precipitation and less than 2 percent is from weathering of parent material. The implication is that little of the soil carbonate represents a sink for atmospheric $C0_2$.

Summary

We present the organic and carbonate carbon on an areal basis for an intensively studied 225,000-acre area in south-central New Mexico. Based on a very detailed knowledge of the soils, amounts of carbon were obtained by estimating the areal percentage for each component of every map unit and assigning laboratory pedons with measured organic carbon and carbonate to each of these map unit components. The arid part of the area has a weighted average organic-carbon content of 2.9 kg m^{-2}. For low-carbonate materials, the arid part contains 26.3 kg m^{-2} of carbonate carbon. Taxonomic placement of major soils is quite predictive of organic carbon and also of carbonate carbon. A rate of carbonate carbon accumulation of 0.1- 1.4 kg m^{-2} per 1,000 years has been computed for soils 1,000 to 4,000 years old. One problem not resolved is the inclusion in the estimates of carbonate carbon in the horizons of buried soils high in carbonate that are below the depth of the map unit component concept. The evidence based on $^{87}Sr/^{86}Sr$ analysis is that very little of the carbonate is a sink for atmospheric $C0_2$.

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